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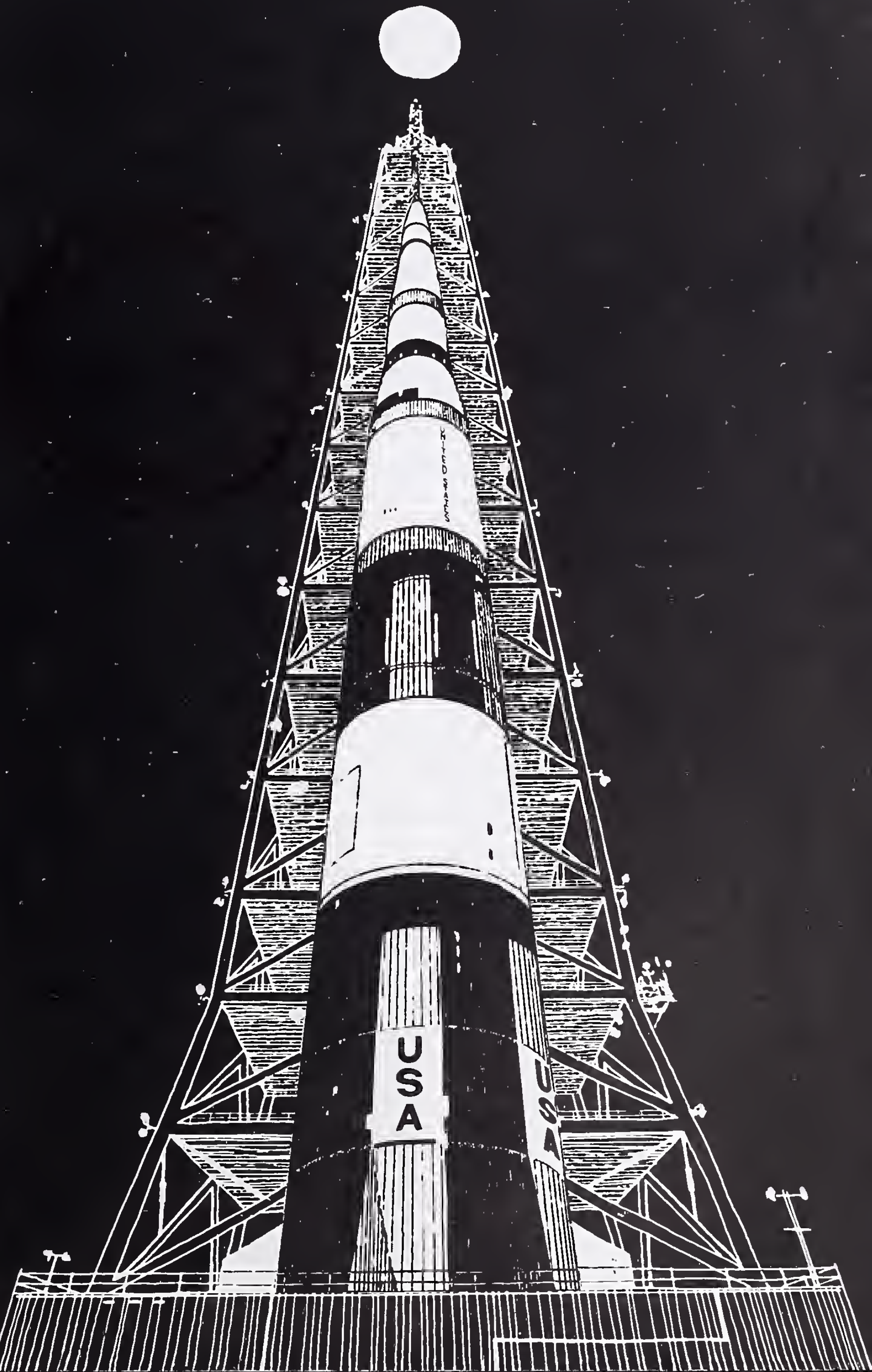

DEFENSE INDUSTRY BULLETIN

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The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcomed and should be forwarded to the Editor at the address shown below.

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DEPARTMENTS

Like a space age Christmas tree, the Saturn booster and the Apollo vehicle stand in the gantry ready for launch. DOD support of the Apollo program is told on the back cover.

Technical Performance Measurement—A Defense Department View

Dr. Norman Waks

The term "Technical Performance Measurement" (TPM) stirs up a great deal of emotion, misconception, and some outright hostility on the part of industry and Defense Department people. The purpose of this article, therefore, is to attempt to define what TPM is, why it is needed, what is being done both to achieve effective "measurement" of technical performance in major programs, and to relate this measurement to the measurement of cost and schedule performance.

At the outset, it should be pointed out that TPM is only one part of the larger subject area of project technical management with which the Office of the Director of Defense Research and Engineering (ODDR&E) is involved. To put things in even broader context, project technical management, in turn, is only a part of total project planning and control with which all elements of the Office of the Secretary of Defense are concerned. Thus this article treats only a small, but important, part of the field of project management: that part which asks how a project is doing in terms of its intended technical goals.

A major share of ODDR&E's management activity is devoted to a continuing search for ways to improve project technical management, whether it be in industry or in DOD. ODDR&E is engaged in a va iety of activities in this field, some of which will be mentioned later. These activities need to be related, one to another, in a way which is both meaningful and beneficial. So an attempt is made to represent the entire defense research and development community—both Government and industry—in the various policy discussions that take place in the Office of the Secretary of Defense by synthesizing the various pieces of the larger picture. In particular, ODDR&E got heavily involved in TPM because of its recognition of the serious differences of opinion within the defense research and development community concerning the state of the art of technical performance measurement. Some companies, and people in DOD, seemed to feel that such a task was easy. Others said it was impossible. Even divisions of the same company disagreed strongly. The truth is probably somewhere between these two extremes. Certainly the job is a very tough one—in fact, in the opinion of many, an order of magnitude more difficult than providing for cost and schedule performance measurement. It is not, however, an impossible task and continued attention must be paid to striving for improvement in the area.

Many companies have already put considerable effort into searching for better ways to do the TPM job, both for its own sake and for purposes of better relating this technique to the measurement of cost and schedule performance. The Defense Department is strongly encouraging such effort. In effect, technical performance control is considered the third leg of the program management control "stool" together with cost and schedule control; and when it is not the same length as the other two legs, it is inevitably the one which "gives" when pressure is applied to the program (or seat of the stool).

Regardless of how much effort has been expended to date, nobody as yet seems to have found a completely satisfactory approach to integrated performance measurement: the direct, one-to-one relating of all three program parameters (cost, schedule and technical) as a program progresses. The technical community appears, in fact, to be facing a long-term job here which can only be accomplished incrementally, building—as is normally done in research and development—on each piece as it moves ahead in its understanding. ODDR&E sees its role in this job as primarily that of actively encouraging industry to do, as rapidly as possible, a job it believes industry needs to do for its own sake and which, in turn, will benefit DOD. It is realized that this job is essentially a creative design job and, therefore, needs to be done at a pace which makes sense—not one in which results are scheduled in advance. ODDR&E intends to hold to such a pace.

Technical performance measurement has been defined by a variety of sources, but there is still much uncertainty as to what is really meant by the term. There is no single definition used throughout DOD or industry. For purposes of this article, and as the basis for reaching broader understanding and agreement, TPM will therefore be defined as:

The regular demonstration through test, or prediction through extrapolation or other forecasting technique, of the degree of actual or anticipated achievement of selected technical goals or objectives of a system, subsystem, component, or equipment program/project, and an accounting, in the causal sense, for the difference between the results of this status reading and that which was planned (what some call "variance analysis") in a fashion which permits appropriate managers to take timely action on indicated problems.

The "goals" and "objectives" here will be specifications in the contract or other master work order, supplemented by the work performer's own goals and objectives as he further shreds out the work to be accomplished by his engineering effort. These goals and objectives are the baselines against which measurements are taken in a TPM effort. In turn, however, they may have to be changed as a result of these very measurements. Hence there is a very close tie between TPM and the systems engineering effort which provides and revises specifications on a program.

Now, obviously everyone in the research and development business has been doing technical performance measurement in one way or another since he started in the business. What is it, then, that ODDR&E is trying to encourage now that is different from what the technical community has been doing all along? Three goals might be listed here:

- Acceleration by the technical community of efforts to improve the means by which it measures, predicts and analyzes variances in technical accomplishment. As the *consequences* of deviation from planned program goals become greater and greater, technical managers must know increasingly earlier and more accurately the "what" and the "why" of actual or anticipated deviations, if they are to have any hope of taking adequate and timely corrective action on undesirable ones.

- Improvement of the means by which the technical community regularly relates *technical* objectives and accomplishments to *cost* and *schedule* objectives and accomplishments. In a military environment, promised technical capability has little meaning for decision makers without the knowledge of when they can really have it (schedule) and what they must give up to get it (cost).

- Improvement of the way in which actual and planned technical performance is presented to management at the various organizational levels. The data, at the moment, is just not meaningful enough.

One specific area in which a lot of thinking is needed with regard to improvement in performance measurement, for example, is that of the *non*-hardware parts of a technical effort, like systems integration, engineering analysis, and design validation. These parts of the effort are accounting for an increasing proportion of current development contracts, especially in the case of those companies which do not charge prototype fabrication to "development."

There are deficiencies even on the more hardware-oriented type of activities, incidentally, such as the design synthesis effort leading to a prototype. In this area it is doubtful whether most contractors can now apply TPM techniques sufficiently well so that the numbers fed into the system at the working supervisor level are considered reliable enough even by them to be used as a basis for decision.

DOD impetus to seek improvements in technical performance measurement and its relationship to cost and schedule objectives and performance was given by publication in December 1967 of DOD Instruction 7000.2, titled "Performance Measurement for Selected Acquisitions." The instruction requires contractors to meet certain criteria for their performance measurement systems on selected contracts. These criteria are intended to apply not only to cost and schedule performance, but to technical performance as well. In this regard, although there have been and still seem to remain some substantial differences of opinion regarding what constitutes good cost and schedule control systems, there is, as already indicated, even more widespread concern and misunderstanding regarding a good technical performance control system. The publication of the instruction brought some of these concerns and misunderstandings to the surface. Therefore, Dr. Finn Larsen, the Deputy Director of Defense Research and Engineering, and Dr. Robert Anthony, then the Assistant Secretary of Defense (Comptroller), agreed that clarification of several sections of the instruction was required. This clarification was provided, on an interim basis, in a joint memorandum issued on May 21, 1968. These and other needed improvements which have been identified are now being incorporated in a revision to the instruction. Once completed, work will proceed on the Guide called for by the instruction. Even before the Guide is issued, however, approval for application of provisions in the current instruction can be obtained on a case-by-case basis.

The Larsen/Anthony memorandum should have helped a lot to improve understanding of DOD's intentions in the technical performance measurement field. The memorandum also served to express the way in which DOD intends to get at this business of performance measurement. It said in this regard that DOD intends to interpret and implement DOD Instruction 7000.2 on performance measurement "with an experimental attitude, with a common sense consideration for the practical problems

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The author gratefully acknowledges the assistance of Harold M. Wakefield, Staff Assistant, in the preparation of this article.

involved, and with the expectation that both the department and industry will work hard at the task of devising better ways of measuring and relating technical effort in the management systems by which major acquisitions are controlled." Parenthetically, it should be noted that ODDR&E intends to follow this approach not just in connection with performance measurement, but on any technical management policy that it promulgates.

One of the more important points that was made perfectly clear in the memorandum is that no contractor is going to be prohibited from doing business with DOD for failing to have a technical performance measurement system that will operate in a completely integrated, traceable fashion with cost and schedule—at least for the foreseeable future. The reason for this is that admittedly DOD does not yet have proven methods by which to provide or administer a set of unambiguous standards for measuring the acceptability of a contractor's technical performmance measurement system.

Further, although DOD recognizes that there is a definite interaction between the three program parameters, the present state of the art does not warrant strict insistence on a contractor's performance measurement system being capable of either immediately or directly showing the effects on the other two parameters, when one of the parameters changes. This is why the memorandum limited the definition of the word "integrated," used in DOD Instruction 7000.2, to mean only that cost, schedule and technical performance measurement must be made against a common work breakdown structure (WBS): the contract WBS. Even here, the whole WBS need not be involved, but only those selected elements (and their related technical parameters) on which overall program success most depends. We need to identify these critical elements and their related technical parameters for the sake of program test planning (and possibly multiple incentive contracting) in any case.

While contractors will not be barred from supplying the Defense Department because of failure to have a technical performance measure system which meets fixed, preestablished standards, all contractors are being encouraged to work just as hard as they possibly can in the development of "reliable, integrated systems for measuring technical performance." In this regard, it is recognized that such an effort will require the attention of industrial top managements if it is to get adequate support and resources. To stimulate this top management attention, the Office of the Secretary of Defense will encourage the Military Departments to make an integrated performance measurement system a source selection factor in all contracts subject to the criteria of DOD Instruction 7000.2. This is being done because it is believed *relative* judgments by DOD are possible on the merits of the performance measurement systems of competing contractors (confirmed by a later validation effort), even if *absolute* judgments cannot be made. Another possible industry motivating device might be that of providing direct incentives within a contract. Undoubtedly there are other ways which can be identified as the effort moves ahead. Ideas on this topic will be most welcome to DOD.

A word now about the intended application of technical performance criteria. These criteria, when developed, will be applied in the same kinds of programs and contracts as will the new cost and schedule criteria. This means that only major projects, and major contracts within these projects, will be directly affected. As a further general rule, DOD expects to apply standards or criteria for technical performance measurement in a quite selective fashion. In this regard, the chances of successful application of the technique are better the farther along in development a program is, and where technical uncertainties are sufficiently low to warrant the use of fixed-price type contracts. Therefore, application of the criteria is proposed first to operational system developments under fixed-price incentive contracts. As we learn, the criteria will then be extended to engineering development efforts. Finally, they may possibly be applied to cost-type contracts. However, if the technical uncertainty in the program is of such a magnitude as to require the Government to contract on a cost-type basis, then it is difficult to see how an integrated performance measurement system involving specific, pre-established performance standards and the measurement of deviation from these standards can be required, however desirable.

For reasons described earlier, the DOD effort in technical performance measurement is directly related, by necessity, to the DOD effort in defining systems engineering and how it should be managed. For example, the Air Force has developed a draft military standard on systems engineering management which requires a technical performance measurement system of *some* type as part of a contractor's so called "System Engineering Plan." After ODDR&E has evaluated this Air Force standard (whose creation the Army and the Navy actively observed), steps may well be taken to use it as a basis for the development of a tri-Service military standard.

In addition to the Air Force systems engineering management stand-

(*Continued on page 17*)

Technical Performance Measurement--A Selective Application

- **Major development contracts within costly programs:**
  - **Operational systems developments before engineering developments.**
  - **Fixed price incentive contracts before cost type contracts.**
- **Critical work breakdown structure elements within major contracts.**
- **Key technical parameters within critical work breakdown structure elements.**

BUSH Sales Aid Contractors and Government

Lieutenant Colonel Felix H. Jewell, USAF
Mrs. Jane Litchfield

BUSH Means Buy United States Here— but "Here" is Overseas

The history of the BUSH program began in mid-1962 when the Secretary of Defense directed an intensified program to reduce DOD expenditures entering the international balance of payments for materials and supplied for use outside the United States. The program placed increased emphasis on the use of U.S. origin items in support of overseas activities of the Defense Department.

When the intensified Buy United States policy was implemented, the cost of procuring American-made products in the United States for overseas delivery was increased. There were government surcharges, export packing charges, insurance fees, and the cost of transportation from the United States. These costs had to be absorbed by the purchasing agency. Even more important to mission-conscious commanders, delivery times for items previously bought overseas greatly increased. When material had been procured overseas, lead-times were short and there were minimum transportation, maintenance and spare parts problems.

While looking for ways to solve these problems of increased cost and slow delivery and still effectively support the Buy United States policy, overseas procurement officers found that many American firms had agents, subsidiaries and affiliates in Europe, with large stocks of U.S.-made supplies in bonded warehouses, from which they supplied their commercial markets. These suppliers were ready, willing and able to contract for delivery of their products direct to U.S. Government activities in Europe, North Africa and the Near East. Further study revealed that many of these companies could deliver FOB overseas destinations at prices equal to or below the prices paid in the Continental United States (CONUS) possibly due to lower sales, marketing and labor costs, and the fact that U.S.-made items imported for delivery to U.S. Government agencies, or delivered from customs bond to U.S. Government agencies, are exempt from import duties and taxes.

The BUSH program was devised to take advantage of these situations. BUSH was originally initiated by the U.S. Air Forces Europe (USAFE) on an experimental basis in March 1963. Pacific Air Forces (PACAF) awarded its first BUSH contract in November 1964. The program continues to grow annually.

Operational BUSH offices are geographically dispersed in order to be closer to the affiliates of U.S. companies. Organizations presently negotiating, awarding and administering BUSH are listed in Figure 1.

All U.S. Government agencies located within authorized countries, such as Army, Navy, State Department (embassies and consulates), Agency for International Development, American Battle Monuments Commission, Department of Commerce, etc., including all their nonappropriated fund activities, are authorized and have used BUSH contracts because of the immediate availability of goods and lower costs. In addition to the government organizations, government contractors performing under cost reimbursement contracts may order from BUSH contracts. The countries covered by the contract are a negotiable factor, although the Government's objective is to obtain as much coverage as possible. Additional countries may be authorized as the need arises.

All U.S. manufacturers of commercial products or their affiliates are

BUSH Contracting Offices

Address	Location
Pacific:	
PACAF BUSH Procurement Office— Japan (DMP–BJ) APO San Francisco 96323	Tachikawa Air Base Tokyo, Japan
PACAF BUSH Procurement Office— Philippines (DMP–BP) APO San Francisco 96528	7th Fl. Amalgamated Dev. Corp. Bldg. Ayala Avenue, Makati, Rizal, Philippines
Europe:	
USAFE Procurement Center, Germany (UPCG) APO New York 09332	Wiesbaden Air Base Wiesbaden, Germany
USAFE Purchasing Center (UK) Box 32, FPO, New York 09510	Keysign House London, England

Figure 1.

solicited to negotiate BUSH contracts. The only criterion for a BUSH contract is that the prices and delivery times for the U.S. end products must offer advantages to the Government over concurrently existing methods of obtaining these same type of commodities from the United States.

Contracting Procedure

The key program element is a firm fixed price, indefinite quantity contract which is executed either with the overseas affiliate of an American firm, or directly with the domestic company. The contractual period is for one year.

BUSH contracts contain two main parts. The first part consists of the contract schedule and the contract clauses. The second part of the contract is an attachment called the Authorized Price List (APL) and consists of all information required by ordering activities to place orders against the contract, the price list, and descriptive or technical data regarding the products. Contractors are encouraged to use commercial catalogs for the descriptive and technical data. The APL is printed and packaged by the contractor, and delivered to the BUSH Procurement Centers for distribution to ordering activities in the field. In some instances the contractor may be provided pre-addressed government mailing labels which enable him to mail APLs direct to ordering activities through the APO system. No postage is required in these cases.

Under the BUSH concept, orders are placed directly by the overseas procuring activity with either the domestic contractor or his overseas affiliate. The contractor then delivers to the overseas destinations, at a price which does not exceed FOB CONUS prices. Landed prices in Europe must not exceed the overseas destination delivered price of CONUS items.

Payments for items ordered against BUSH contracts are made by U.S. dollar checks, direct to the firm or to a bank in the United States.

Contractors are asked to submit, along with their proposals, copies of any existing government contracts for the products they propose for a BUSH contract, GSA Federal Supply Schedules, or published commercial or government price lists. In the absence of these, contractors may be requested to submit cost or pricing data. Item pricing for a BUSH contract is all inclusive, and may incorporate such things as packing and preservation costs, standard government-required features, such as radio interference suppressors, installation of, and operator training for equipment, and a service period for company-installed equipment and machines. Quantity discounts are indicated separately.

Growth of BUSH Contracts

FY	Contracts	Expenditures
63	3	$ 154,000
64	23	600,000
65	45	3,000,000
66	75	9,000,000
67	74	13,000,000
68	90	20,500,000
69	110*	30,000,000*

* Estimated

Figure 2.

Commercial, off-the-shelf products for which there are recurring requirements and which are usually purchased by procurement activities of overseas U.S. Armed Forces are suitable for inclusion in BUSH contracts. Contracts also have been written for rental of U.S.-manufactured equipment. Examples of products currently under contract are: office machines of all types, special paints, construction materials, upholstery fabrics, recording tape and equipment, cleaning materials and solvents, motor vehicle chemicals, light bulbs, background music and sound systems, graphic products, and reflective products.

There are some limitations as to the kind of items which can be placed on BUSH contracts. The following products are excluded from the BUSH Program:

- Items stocked by the General Services Administration (GSA) Stores Depots.
- Items covered by the GSA National Buy Program.
- Items for medical use.
- Items that affect safety of flight.
- Items that require quality assurance inspection by the Government.
- Items that are of a strictly military nature.
- Items that are assigned to the U.S. Army-Europe under Single Service Procurement Assignment Procedures. (Such products are vehicles and vehicle spare parts, tires and tubes, plumbing fixtures and accessories, space heating equipment and water heaters, fuel burning equipment units, lumber and lumber products, millwork, household and office furniture, cabinets, lockers, bins, industrial gases, solid fuel, and subsistence.)

Delivery Methods

Another principal factor of the BUSH contract concerns delivery points. The mode of transportation is the contractor's concern, but he must deliver FOB overseas destinations. Four methods of contract deliveries are acceptable and any one, or a combination of the four, offering advantages to the Government may be used in an individual contract. They are:

- Direct overseas delivery to the orderer by the contractor.
- Delivery to foreign ports of debarkation (RODs) for U.S. Government acceptance and trans-shipment to a final destination.
- Delivery to a central overseas delivery point for U.S. Government acceptance and trans-shipment to final destination.
- Delivery through the U.S. Postal System direct to the designated APO/FPO of the overseas orderer for mailable goods.

The delivery schedule in BUSH contracts is one of the main advantages over normal procurement methods. BUSH contracts contain two separate delivery schedule provisions. The "Routine Delivery" schedule sets forth the maximum time allowed for delivery by the contractor. This maximum delivery schedule is necessary because of the various destinations and the multitude of items in the contract. The routine delivery schedule will always apply unless action is taken by the ordering office under the

second delivery provision, "Accelerated Delivery." In many cases contractors will have some of the items in the contract in stock and available for immediate shipment. The ordering office contacts the contractor and negotiates a shorter delivery schedule, which is then specified in the Delivery Order and becomes mandatory upon the contractor. Every effort is made to include realistic delivery schedules for each item in the Authorized Price List. Many U.S. companies have found that bonded warehouse arrangements in Europe are highly satisfactory in expediting delivery of high-usage items and for easier customs clearance. This type of arrangement is encouraged wherever possible; however, it is not a criterion for issuance of a BUSH contract.

An additional advantage of BUSH contracts is that the fulfillment of commercial warranties is completely practical as many companies have branch offices located throughout Europe and the Near East. The contractors' commercial warranty certificates, normally inclosed in the packing cartons, are controlled by appropriate military personnel who monitor the warranty period, and insure that servicing is performed in accordance with the terms of the contract. For those products for which no certificate is issued, contractors label the cartons or packages (usually by stenciling) so that the user will know the products are covered by a warranty.

Lieutenant Colonel Felix H. Jewell, USAF, is Chief, Pacific Air Forces BUSH Procurement Office, and designed and implemented the original BUSH program. He holds a masters degree in Logistics Management from the Air Force Institute of Technology.

Advantage of BUSH Contracts

BUSH contracts offer an impressive list of advantages to the U.S. Government and to the contractor. Advantages to the Government include:

- FOB overseas delivery prices equal to or lower than prices for items bought in the United States and shipped overseas at government expense.
- As all BUSH contractors deliver to overseas destinations, overseas packing costs are eliminated or reduced through the use of commercial export packing.
- Reduction of U.S. Government costs due to overseas shipment losses, damages and pilferage since the contractor assumes liability for overseas shipments.
- Overseas warranties on U.S.-made equipment (nor normally associated with CONUS-procured equipment) or lower unit prices where the companies have no overseas facilities.
- Reduced pipeline time for overseas deliveries, as many contractors pre-position their high-volume products in bonded areas overseas for quick delivery. Faster delivery increases supply effectiveness and decreases inventory needs. Faster delivery also permits smaller individual orders which allows improved local funds management.
- Overseas installation of equipment and check out by company trained technicians.
- Government personnel operator training conducted by the contractor at overseas locations.
- Stimulation of purchases of U.S. end products under $500 which are now exempt under the overall Buy United States policy.
- Placement of orders by overseas activities direct to contractor's overseas locations, thereby reducing administrative delays in purchase request transmission and order placement time.
- Quick reaction time to emergency orders.

Advantages to the contractor include:

- Increased international exports and sales with improved foreign service. International organizations benefit from sales and expected service of their equipment.
- Receipt of all overseas orders in a centralized office regardless of where the order is issued. Orders can be edited to reduce errors and corrected locally prior to shipment/delivery.
- Improved overseas support of contractor equipment since the final delivery destinations are known. Internal company planning for technician training needs and for prepositioning equipment, supplies and spare parts can be coordinated internally prior to their needs—a practical impossibility with the current CONUS procurement procedures.
- Identification of overseas ordering activities for the contractor. This information can be used to plan for future sales and service, office size at each location, and impending personnel requirement.

U.S. companies have been establishing themselves in the foreign areas at a rate of 600 to 700 a year for the past five years. The expansion and continued success of the BUSH Procurement Program seems assured if the majority of the U.S. companies now located or represented overseas participate in the program. This participation will be enhanced as the requiring and using activities advise the BUSH offices of products that may be susceptible to the BUSH Procurement Program.

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Small Business Administration Technology Utilization Program

Clyde Bothmer

[Editor's Note: This is the fifth in a series of articles contributed to the *Defense Industry Bulletin* by the Small Business Administration. Clyde Bothmer, the author, is Deputy Associate Administrator of the Small Business Administration.]

When the figures for FY 1968 are finally totaled, the research and development spending by all Federal agencies will probably amount to almost $17 billion. Between FY 1957 and FY 1967, nearly $100 billion were spent by the Federal Government for research and development in the programs of defense, space exploration, atomic energy, education, health and welfare, to name only a few; and the trend is upward. The work for which those dollars paid has produced over a million technical documents now in the possession of the various agencies, and available to the public.

When so much material with such a vast scope exists, one might suspect that buried in it may be some critically important technical breakthrough, equivalent in importance perhaps to xerography or the transistor, and it will never by sifted from its surroundings and recognized. While this may be unlikely, it is entirely possible that lesser developments, such as a technical improvement in a manufacturing process, might spring from the research and development funded by the taxpayers. If only 10 percent of the documentation owned by the Government had useful commercial potential, thousands of documents, having already served their intended purpose, would be available to the economy, in effect, without cost. This possibility is ample justification for government programs devoted to making Federal technical information available to industry and the general public. These programs, may be referred to under the general heading of "technology utilization."

There are a number of active technology utilization programs. Four are of particular significance: those of the Defense Department, the National Aeronautics and Space Administration (NASA), and the Atomic Energy Commission (AEC), all of which are heavily involved in research and development; and the Office of State Technical Services of the Commerce Department which, like the Small Business Administration (SBA), is concerned primarily with providing information to potential users.

While all of these agencies do an excellent job of disseminating information, there are indications that small firms are not participating fully in the programs. For example, an examination of the industrial interest pattern in NASA *Tech Briefs*, conducted at the University of Maryland, indicated that a much higher proportion of large business than small business is taking advantage of the *Tech Brief* program. Reasons for this can only be deduced but two causes seem logical: most small businessmen are not aware of the *Tech Brief* program, perhaps having never seen the publication; and most small businesses lack the in-house technical capability to properly evaluate the potential or impact of a particular piece of new technology on present products or processes. Additionally, the simple communication of the information provides no guarantee that the business will benefit. The small business may lack the capability to act on information, even after receiving it. The small business may actually be overwhelmed by material available, unable to review, digest and evaluate the possibilities. Even if a small company has been able to evaluate the possibilities of a new piece of technical information, it may still lack the capability to exploit that information. In other words, a new process or product may do a small company no good in the absence of the required capability in the marketing, production, management, or financial fields. The latter problems do not fall within the responsibilities of the agencies mentioned previously, but are definitely within the charter of SBA.

These considerations prompted SBA, with its varied programs of technical, financial, and management assistance, to establish a program which would complement existing technology transfer projects. In June 1967, SBA, on an experimental basis, created the Technology Utilization Division under its Office of Management Assistance. The division's mission is to tailor and implement an effective technology transfer and utilization program focused primarily on small manufacturing concerns. The planning phase is essentially complete, and implementation has begun. The program consists of three basic approaches: education, dissemination, and assistance.

Education

A great deal of emphasis is being placed on conferences, seminars and workshops on new technology, especially in the early phases of the program. Large conferences, staged in cooperation with NASA and AEC whenever possible, introduce selected audiences to new technology of commercial potential and to the ways and means of tapping the Government's accumulation of technological information. Seminars and workshops follow the conferences, at which time greater substance and definition are given to certain technologies or specific innovations. Attendees are manufacturers and entrepreneurs who have vital commercial interests in the particular subjects in question.

SBA works closely with universities and research institutes at the seminar/workshop level. SBA's technology utilization officers and the Service Corps of Retired Executives (SCORE) follow up and attempt to provide whatever assistance is necessary for the small businessman to capitalize on any interesting aspect or aspects of these training programs. (For a description of the organization and activities of SCORE see article, "Management Counseling for Small Business," *Defense Industry Bulletin*, September 1968, page 27.)

Five conferences, ranging in size from 100 to 500 attendees, were held during FY 1968. Either NASA or AEC, or both, co-sponsored three of these conferences and were responsible for the technical presentations. SBA took the lead on the other two conferences, cooperating with other agencies. SBA's role is one of explaining technical information programs and how these programs impinge upon and can facilitate the technology utilization process. In addition to these conferences, numerous seminars and workshops covering technical subjects, new product development and use of government sources of information have been conducted, often in cooperation with institutions participating in the State Technical Services Program.

Dissemination

Since so much information is distributed through other government programs, it seemed prudent for SBA to stay out of the mass dissemination activity. What was needed for small business was a program focused on the identification of potential new products and new processes in defined subject areas. Therefore, SBA has embarked on a modest publication program intended to fill this void. A series of booklets, perhaps as many as 10, will be issued in FY 1969. These publications will be subject oriented, draw material from government-wide sources, and contain abstracts of specific innovations. The SBA staff will attempt to select ideas with the best commercial potential and, wherever possible, to suggest a commercial application, despite the obvious problems in such a course.

The first publication was titled "Selected Advances in Electrical Technology." Released in March 1968, it was sent to top management of 17,000 small electrical and electronic manufacturers. Publications on metal joining and tooling have also been sent to managements of firms with interest in these topics. Other publications in process involve such subjects as instrumentation, and computer hardware and software.

Assistance

In the technical, managerial and financial areas, SBA is in a unique position and has the greatest opportunity to contribute to the technology utilization process. It is there that the most formidable barriers to the use of new technology exist, particularly for small manufacturers. The intent is to provide assistance to the small businessman, beginning at the point where other technology dissemination programs end. By cooperating and maintaining close contact with institutions participating in the State Technical Services Program and NASA's dissemination efforts, SBA will be able to assist those small businesses interested in active pursuit of the commercial development of a new idea, but stymied by managerial or financial problems. Such situations will also emerge from SBA's own dissemination efforts.

Responsibility for performing the tasks outlined herein will rest upon the entire staff of SBA, since use of the full range of services is an important part of the program. The principal part of the burden, however, will belong to the technology utilization officers (TUO), located regionally. Plans call for 16 TUOs in the SBA organization by the end of FY 1969. TUOs will generally be responsible for:

- **Dissemination, when appropriate.** Each TUO maintains contact with representatives of DOD, NASA, and AEC in his area, and with organizations affilitated with the State Technical Services Program. He makes appropriate distribution of information from those sources, supplemental to the SBA publications.
- **Recruitment of SCORE people with a technical bent.** The TUO maintains a thorough knowledge of the SCORE personnel in his area, which permits deployment of the proper SCORE talent to aid in overcoming problems associated with the application of new technological developments. At the same time he will also establish and maintain contact with organizations which are likely to have technically oriented, potential SCORE members; and he will actively seek to recruit such prospects.
- **Working with and being the focal point of a network of SBA personnel in every state of his area.** The purpose of the network is to interface comprehensively with other agencies and to enable SBA to assist in the technology utilization process when needed, whether the need be technical, managerial, or financial in nature.

SBA intends to make its contribution by applying the full range of its services to ensure that a small firm has every chance of locating and using government-controlled technical information. Although it is too early to measure success, this experimental program, dedicated to strengthening the technological posture of small business, offers great potential for extensive business development of previously unexploited technology. This growth will benefit the economy through increased and updated production, the public by availability of new and improved consumer goods, and the defense industry by making possible the competitive production of the most advanced equipment.

Navy Wins Approval for New OMEGA Stations

The Secretary of Defense has approved four more Navy OMEGA Navigation System stations and the purchase of ship and aircraft receiving equipment.

The eight-station OMEGA system will go on the air in late 1972. It will provide world-wide navigational signals from Very Low Frequency (VLF) shore-based transmitters.

Four OMEGA transmitter stations are now in operation serving civilian and military ships and aircraft. The four new stations will be located in the Western Pacific, Tasmanian Sea, Indian Ocean, and southern South America.

The Navy is negotiating for permission to build and operate the stations at foreign sites. Foreign participation in the program is appropriate since OMEGA will be useful to all navigators, both military and civilian. Therefore, foreign partners are being sought to join the United States in completing the OMEGA system.

Defense Industry Employees Cited for Cost Reduction Efforts

Thirty aerospace industry employees were honored for cost reduction efforts at the Fourth Annual Air Force/Industry Cost Reduction Awards Ceremony and Workshop held October 3 in Los Angeles, Calif. The awards, which are given annually, recognize contractor employees who have submitted the most representative cost reduction savings suggestions during the preceding fiscal year.

A total of 126 industry representatives have now been cited by the Air Force for their cost reduction achievements since the awards program was started in 1965.

Award winners this year, representing 20 defense contractors, are:

Aerojet-General Corp.
Sacramento, Calif.
- Jennings Braun
- Milton S. Lev
- Jose C. Vasquez

Air Research Manufacturing Co.
Phoenix, Ariz.
- David Schwerdt

American Chain & Cable Co., Inc.
York, Pa.
- Gerald Ensminger
- Henri Gunsch

ARO, Inc.
Arnold AFS, Tenn.
- Elmer L. Duckett
- Edward E. Erickson
- Floyd G. Moore Jr.

The Boeing Co.
Vandenberg AFB, Calif.
- Richard E. Roller

Dallas Airmotive, Inc.
Dallas, Tex.
- Jack Morris

General Dynamics Corp.
San Diego, Calif.
- Raymond J. Schulte

General Electric Co.
Valley Forge, Pa.
- Louis A. Clairmont
- Paul P. McGavin

Kenway Engineering, Inc.
Bountiful, Utah
- Kenneth A. Richins

Lockheed Missile & Space Co.
Sunnyvale, Calif.
- Jack L. Bellamy

Loral Electronic Systems
Bronx, N. Y.
- Marvin Blinder
- Allen Chertoff

Martin Marietta Corp.
Denver, Colo.
- John R. Anderies

McDonnell-Douglas Corp.
St. Louis, Mo.
- Harry J. Scheffler

McDonnell-Douglas Corp.
Tulsa, Okla.
- Amos Kelley

Melpar, Inc.
Falls Church, Va.
- Mrs. Frieda K. Bernhard

Pan American World Airways
Patrick AFB, Fla.
- Talmage G. Bennett

TRW, Inc.
Redondo Beach, Calif.
- Mrs. Soo Chen Yao

United Aircraft Corp.
Sunnyvale, Calif.
- George Kloves
- John M. Lynch
- John H. Pfeiffer
- George W. Marringer

Vitro Corporation of America
Eglin AFB, Fla.
- Austrial E. Gomillion

Williamson Body & Equipment Co.
Salt Lake City, Utah
- David S. Ostler

Today, 87 parent companies, with 211 plants and divisions, are active in the Defense/Contractor Cost Reduction Program. All defense contractors are encouraged to participate in the program and invited to report their savings to DOD on a semiannual basis. Information and detailed guidance for such participation are available in the Defense Contractor Cost Reduction Program Handbook (DOD 7720.12–H).

System Engineering Facility Established by Defense Communications Agency

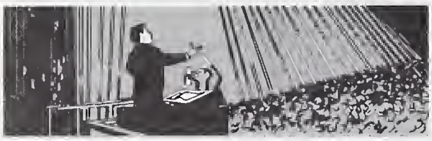
The Defense Communications Agency (DCA) has established a System Engineering Facility as a field activity under the command of the Director of DCA. The new organization will perform system engineering for the overall Defense Communications System, and provide strategic communications engineering support, guidance and assistance to DCA and the Military Departments.

An initial complement of about 40 persons, which will staff the activity, will be located temporarily at the headquarters of DCA in Arlington, Va., pending decision on a permanent site in the metropolitan Washington, D.C., area. Captain William T. Peale, USN, has been designated Chief of the System Engineering Facility.

The DCA System Engineering Facility will provide a complete facility for overall system engineering of the Defense Communications System, and the physical equipment and instrumentation for test and evaluation necessary to ensure achievement of the system engineering objectives. This will encompass the automatic switched networks, the transmission subsystem and the operational direction facilities, and the evolutionary development of the Defense Communications System into a single integrated system.

To accomplish its mission, the System Engineering Facility will provide a test bed for systems engineering, system planning support and testing of telecommunication projects, and for the development and validation of computer programs for control and operation of the Defense Communications System of the future. To enhance the interrelationship between system and subsystem engineering, the facility and the Defense Communications Engineering Office will be collocated.

At the facility, switches of the Automatic Voice Network and the Automatic Digital Network will be tied into the Defense Communications System for test purposes only, as will Automatic Secure Voice Communications and the Defense Special Security Communications System in the future.



Managing Research and Development Programs

Address by Dr. John S. Foster Jr., Dir., Defense Research and Engineering, at EASCON '68 Convention and Exposition of the Institute of Electrical and Electronics Engineers, Washington, D. C., Sept. 9, 1968.

I have selected three aspects of the ways in which we in Defense Research and Engineering try to make sure that we are utilizing wisely the resources which are brought to bear on national security. The first is a management tool, called the Development Concept Paper, which we use to support the decision whether to go after a major new weapon system. The second addresses the question of how we make sure that the methods of managing and contracting for the development of major new systems are wisely and appropriately selected. The third deals with techniques to help us give clear direction to the thousands of projects which make up our investment in the technological base.

One of the most critical problems we face is making the decision to initiate, or to delay the development of a major new weapon system. Hundreds of millions of dollars of development are involved in a major system, and billions of dollars in its procurement and operation. The security of the United States is at stake. The decision rests on the answers to questions that are complex. These questions involve the character and timing of present and possible military threats with which we may have to cope. Such threats are developed in secrecy and often revealed to us only at late stages. The questions involve the extent to which we believe these future threats can be countered by our present weapon systems, and how effective the proposed new systems might be.

They invlove the difficult projection of confidence in technologies proposed for the future systems.

There are also questions of timing. Should we move now, or wait a year or two for a still newer generation of equipment? The cost of premature commitment to an advanced system can lead to wasteful changes of direction; but undue delay can later necessitate an equally wasteful crash effort to develop a system in time to meet an urgent requirement.

Granted, such decisions are difficult. But what is really important is that the decisions be right.

These decisions must often be made in an atmosphere of controversy with partisans for various options separately pleading their cases, citing their own sets of facts, assumptions and analyses. The Secretary of Defense and his principal advisors will not have the opportunity to read the tens of thousands of pages produced on each of the major issues presented for decision. Nor do these pages often clearly identify the issues or alternatives that are involved. Those in support of each position have usually assembled enough evidence and analysis to make a very effective case for their side, but frequently using different assumptions and ground rules.

We all have a tendency to describe a system in such technical terms, from so many disciplines, that its real significance to our security is not made clear. Sometimes enthusiasm to get on with an exciting technical innovation substitutes for justification that the effort is in the best interest of national security.

Recognizing the tendency for these kinds of things to develop, we ask

Hon. John S. Foster Jr.

what can we give the decision maker to enhance his opportunity to make the correct decision? How do we come to grips with the issues on which the decision must turn?

Now, what the decision maker would really like to have is just one paper; short enough so that he can study it carefully; comprehensive enough to present the issues, facts and analysis which are truly relevant, and material, to his decision; comprehensible so he can easily understand it; and impartial, in that it includes the best case which can be made for the system and the best case which can be made against it, all on the same base.

Development Concept Papers

During the past year, we have devoted a major effort to generating just such papers which we call Development Concept Papers (DCPs). As you can well imagine, their formulation can be exceedingly difficult. It is not enough to have a long list of pros, and a long list of cons. We must isolate out the crucial issues on which the decision must depend, and weave those together in a coherent and illuminating form.

A most important innovation of this document is that it is signed by the Secretary, or Assistant Secretary

for Research and Development, of each Military Department involved, and by the Chairman of the Joint Chiefs of Staff or the Assistant Secretaries of Defense when their functions are involved. These signatures mean that, from the point of view of their offices, the paper contains the very best arguments to support their positions. The signatures also mean that they agree that the arguments presented on the other sides are substantive and relevant.

We have maintained the discipline that all substantive arguments must be stated in the DCP within 20 pages, and that no signer may require an appendix to present his special pleading.

It is not only our perception of a proposed system and its significance which is hammered out on this anvil. The mission and concept of the proposed system itself are also often changed. The process serves to set aside any peripheral considerations which had preoccupied earlier debates, and bring into focus more current and central issues.

Clearly this practice is new to us and somewhat experimental. While we are very excited, the true test of its worth must come with time and experience.

Examples of DCP Process

Let me discuss two examples.

One DCP deals with the next generation of our military communications satellite system. A year ago, when we attempted the preparation of a concept paper on this system, the idea of a satellite system for military communications seemed attractive. A development program had been initiated five years earlier and there was widespread support from both users and communicators. However, as we developed the rationale, we realized that the role for which the system had been intended clearly could not justify the costs. The system had seemed most important for communications between headquarters in all-out nuclear war, but this could now probably be better done with other systems. However, on analysis, the satellite system looked more attractive for command communication into and within very important areas of crisis or limited conflict. The DCP process then led us to consider the potential value of the much higher gain satellite antenna systems which were "around the corner." These offered much lower net communications costs and much more easily transportable terminals, enhancing the adaptability of the system to the rapid establishment of military communications into areas of crisis. This led to a decision to proceed with a system which will be operational a year or two later than the system we considered when we started the DCP process. It will cost a third or so more but will have 5 to 10 times the capacity, and will supply some key capabilities for both strategic and tactical communications in contingencies and limited wars.

Thus the concept, principle uses, technology, schedule and costs of the proposed system all underwent major changes due to the DCP process. The end result is that we are adding a very important and versatile system to our inventory.

Another example is the VSX aircraft which we are developing to conduct anti-submarine warfare from aircraft carriers. When this concept paper was started, it was thought that the principal issues would be the characteristics and schedule of the aircraft. There were heated debates about these issues initially, but they were soon settled. A much more basic issue which came into focus under this process was whether we needed to rely at all on carrier-based aircraft for anti-submarine warfare, or whether it was wiser to rely only on land-based aircraft. Analyzing this with the Navy, it became apparent that the answer was a function of the vulnerability of carriers, the availability and distribution of shore bases and their distances from the areas of importance for anti-submarine warfare. The DCP which resulted anaylzes these issues. The decision to develop the VSX aircraft then followed rather easily.

We have so far submitted 14 such papers and each has led to a firm decision. About 80 are currently in process.

I must add that one of the most comforting feelings which a technical manager can have is to realize that the strongest possible case against his program has been made, and examined at the highest levels, and that the result was the decision to go for the next major step.

Let me summarize. The use of a Development Concept Paper injects several important disciplines. It provides the rationale which led to the decision. It includes the best supporting case and the best opposing case. It requires the concurrence of all responsible parties to its facts and arguments. It serves to communicate the decision and its rationale to the Services. It specifies the threshold for changes in threat, cost, performance and schedule which must lead to a review of the decision. Therefore, it serves to delegate authority to proceed with development within these limits.

The issues treated in these DCPs are of very serious importance to our security. It is crucial that the assumptions and rationale involved be subjected to the most careful and competent scrutiny. For this reason, I am undertaking to make some of them available, once certain private matters have been deleted, to selected organizations outside the Defense Department. I will be soliciting their earnest and frank appraisal and suggestions.

Managing the System Development Process

Let me now turn to my second topic —the management of the system development process. In 1964, we introduced two new procedures designed to help make sure that development of major systems was an orderly and efficient one, under firm management control. These procedures are called concept formulation and contract definition. Allow me to take a moment to recall for you what is to be accomplished in each of these procedures. The purpose of the concept formulation phase is to make sure that adequate requirements analysis, experimental work, and design studies are done to give us high assurance that major uncertainties have been eliminated prior to the start of full scale development. Thus, concept formulation must show four things:

- That mission and performance envelopes have been defined and the cost effectiveness of the proposed system has been shown to be more favorable than that for any other competing system.
- That a thorough trade-off analysis has selected the best technical approach.
- That the remaining work to be done is primarily of an engineering rather than an experimental character.

• That the cost and schedule estimates are credible and acceptable.

Let me repeat, the purpose is to make sure all of these things are clearly demonstrated, before we are willing to commit DOD to the development and deployment of a major weapon system. Clearly the completion of concept formulation may require a great deal of exploratory and advance development of technologies and designs. During this process, a number of systems concepts may be rejected, shelved, or modified.

After concept formulation has been completed, if we decide to proceed with further development, we initiate the second procedure called contract definition. This process normally involves competitive contractors who must produce firm management and contract plans, firm and realistic schedules and cost estimates for development. The competing contractors must also verify technical approaches and identify risk areas. Only with these results in hand will we confirm the decision to proceed with large scale engineering development of a major weapon system.

Four years have passed since these approaches were introduced, and I believe it is not too early to take stock and to ask whether still further changes in theory or practice might be required. In my experience, the introduction of concept formulation and contract definition has, in many cases, led to a great deal more care and thought being given to formulating the purpose, concept and functioning of proposed systems. It has led to an emphasis on the development of advanced technologies and techniques before commitment to a systems development program. The result has often been a greatly increased confidence that we can, in fact, acquire a weapon system with efficient use of our development resources.

On the other hand, their use has sometimes led to over-confidence that engineering developments will be straightforward and free of surprises, and hence to pressure for tough fixed-price contracts. There are also strong pressures to enter contract definition before the four conditions of concept formulation are fully met, in order to establish a driving commitment to procure. If these procedures lead DOD and its contractors to underemphasis or gloss over the tough problems or risks which remain in the development of a system, the result can be to reduce the incentive to pursue needed technical advances. Such pressures could also strain the technical integrity of the participants. In either case, such practices would defeat the purposes which led to the introduction of these management concepts.

There are programs with clear requirements and solutions, and little technical risk, where formal concept formulation and contract definition may introduce costs and delays that are not justified. There are programs where the research and development costs are such a small fraction of the total procurement costs or the total costs of ownership, that the choice between alternative technologies or designs should depend on a competition in system hardware rather than in paper. There are cases, even for major weapon systems, where engineering development risks should be accepted and flexibly shared by the Government and the contractor.

So far, it seems to me, the contracting flexibility exists. It is the tendency to force a Procrustean approach on our contracting procedures that needs our attention. We must be prepared to experiment and innovate with these tools. I believe that here, too, our approach must be to require an explicit formulation of the choice of program management and the rationale for that choice. Accordingly, I have initiated the practice that any DCP which analyzes development of a major weapon system will also analyze the appropriateness of contract definition or of competition in hardware, or of other forms of program management. I have also directed that where contract definition is required, the Development Plan produced must discuss the appropriate contract conditions for development in the light of these risks and uncertainties. I firmly believe these steps will facilitate the exercise of prudent judgment in the application of management and contracting tools.

Now to my third subject—the strategy for managing the thousands of smaller programs. We spend almost $2.5 billion annually on projects covering every engineering specialty and most scientific disciplines. They represent over 10 percent of the nation's investment in research and development. We cannot manage these individual projects from the Office of the Secretary of Defense, nor should we even try. We must treat aggregates of projects. We must support disciplines which give promise of major innovations of possible defense significance. We must support efforts to seek and develop new techniques, especially where our systems are deficient or where new technologies can permit the concept of new systems. The problem of setting priorities is simply that it requires the assessment of so many activities and needs.

Yet we must assure ourselves that the overall investment is wise—effective and adequate. No one management technique or approach will give us this assurance.

Investment in Technology Base

One approach, which we use, is to carry out a continual topical sampling in depth. When we face a decision on the possibility and timing of a major new system, we probe hard and deeply into the technological programs on which it would depend, and into projects which might offer alternatives and further advances. These projects achieve a high visibility for awhile, and are often subject to redirection and emphasis. Those that seem to be on the critical path to the success of the proposed new system may be kept in the spotlight for a long time.

When we were wrestling with the decision on the next generation defense satellite communication system, for example, we explored carefully the state of the art in the technologies which contribute to communications satellites. This led to the decision to delay the system so that we could go for the high-gain, narrow-beam antennas on a stabilized platform. It also led to a number of confirmations and modifications to projects from which a still later generation system can emerge, such as phased array antennas, electrostatic propulsion systems, nuclear batteries and solid state microwave components.

But this topical sampling is really not enough. As I stressed earlier, managing defense research and engineering demands the discipline of fully explicit reasoning and judgments. Without an explicit and complete strategy, we do not know whether we have really thought through the situation, and we cannot expose our full strategy to the constructive criticism of others. We cannot com-

municate our reasoning effectively to those who must be guided by it.

So we must do more. In fact, we are now experimenting with two new approaches. One is the subject of a current Air Force experiment. This approach attempts to set the levels of effort in exploratory development by relating clusters of projects to alternative possible systems and long-term operational objectives. It is a serious attempt to provide reference material for research and development management. We intend to evaluate carefully the results of this experiment because we recognize the problems and possible risks in compiling and relating individual judgments about relatively long-range efforts.

Another new management approach, with which we are experimenting, is a series of Technical Area Plans. Each plan examines the parts of the total research and development program which support our capability in a technical area such as electronic warfare, jet engines, or reconnaissance. It will examine the present and evolving role which that area is playing in national security, and the role it might play if promises were realized. It will identify the critical inadequacies in our present systems, and the most significant needs of new systems. It will identify the important technological alternatives, their status, their risks, and the probable time and effort required to establish their feasibility and utility. It will identify the major studies, experiments and prototypes needed to assess these technologies. It will trace the demands on the underlying scientific and engineering disciplines, and sort out the new opportunities emerging from those disciplines. Finally, it will specify the goals, priorities, timings and inter-relationships with which these various efforts will be pursued.

The rationale for experimenting with these approaches is that we must be persuaded that our resources are wisely and effectively invested. We must be persuaded that important opportunities and needs have been indentified with proper priority, and that sufficient efforts are underway. Where both urgent need and high risk are involved, there must be a diligent search for realistic alternatives. We must be confident that our efforts are rationally distributed between the needs for immediate pay-off and for longer range advances.

These approaches are difficult to pursue because they depend upon probabilities and uncertainties. But such Technical Plans are not intended to be exhaustive, to trace all of the technical roots of every potential advance, nor could they be. They are intended, rather, to highlight the technologies on which our future capabilities now seem to depend most critically and those which offer major advances, so that we can be sure adequate priority is directed to their pursuit and exploitation. Thus, these plans serve to make explicit and visible our program priorities, and the rationale behind those priorities. The attempt to view our programs in this way has already rewarded us by bringing opportunities and inefficiencies into focus. It has led to very important changes in our programs.

In electronic warfare, it has led us to supplement our fruitful Quick Reaction Program with greater emphasis on more orderly advanced and engineering development of multimode equipment, and on technology for countering new classes of threats. It has lead us to stress technology for the integration of extant electronic warfare equipment aboard ship, into the whole command and control network of ship defense, even at the expense of some new equipments.

In navigation, it has led us to realize that highly stable inertial navigators, which have been under development for weapon delivery, can potentially be operated with proposed satellite navigation systems, so as to extend their applicability and greatly reduce their cost.

In battlefield surveillance, it has led us to a much greater emphasis on newer sensor technologies.

Even in basic research fields we have applied this kind of explicit review of on-going programs and goals. For example, we decided about two years ago to phase out our support of high energy physics research. This decision was based upon a careful assessment of the relevance and potential to national security of this work, compared with our other basic research needs, and upon the clear national responsibilities of the Atomic Energy Commission and the National Science Foundation for this area.

I wish to challenge you to make explicit the rationale behind the Technical Area Plans within your laboratories or corporations. You are investing your talents and resources in certain ways, because you perceive a path from your work to something of importance to our society. You should not accept the rationalization sometimes presented to industrial management that a research and development project is supported by DOD and, therefore, must be relevant and important. You must be satisfied that programs which you manage, whether supported by DOD or from other sources, make excellent sense. Let us exchange our best explicit judgment regarding technical opportunities and priorities. I intend to present our technical area strategies for criticism by selected groups of individuals and contractors. I hope you will reciprocate. It is crucial to develop our collective best reasoning.

Let me make clear that many approaches to research and development management must be used together. No one technique should be exclusive. A new management tool, no matter how exciting in theory, must mature through use in conjunction with other methods.

I suspect you have recognized two of my fundamental convictions on management. One is that wise decisions are greatly aided by the discipline of writing down, explicitly and succinctly, the rationale for decision. The other is that decisions on defense research and development must be closely criticized by all who care about national security.

Army To Close 23 Nike Hercules Sites

Twenty-three Nike Hercules firing sites and seven headquarters installations have been scheduled for closure by the U.S. Army.

The firing sites and installations are being shut down to help reduce expenditures for FY 1969 as required by the Revenue and Expenditure Control Act of 1968.

It is expected that $18.8 million will be saved by these closings in FY 1969, and $54 million in each succeeding year as a result.

Although it was originally planned to close some of the sites by the summer of 1970, the closing was speeded to help meet DOD's share of the limitations imposed by the Revenue and Expenditure Control Act.

Technical Objective Document Program

Aerospace power, one of the vital elements of national security, depends on a vigorous and continuous application of the most up-to-date technology.

The continued advancement in technology required to maintain aerospace leadership is the result of a maximum degree of teamwork between the Air Force and the scientific and industrial community. Such teamwork is possible only if adequate means are provided for defining technical problems, and exchanging research and development information basic to their solution.

To implement this team effort and promote its success, the Air Force releases to qualified scientific and industrial organizations documents known as Technical Objectives to be attained for future operational capabilities desired by the Air Force. It is through the combined efforts of the Air Force and the scientific and industrial community that the greatest progress can be made.

Air Force Technical Objectives are statements of efforts needed to satisfy an existing or anticipated need. They are prepared and compiled into Technical Objective Documents (TODs) by the Air Force laboratories of the Air Force Systems Command (AFSC) and the Office of Aerospace Research (OAR). These TODs are published and distributed by the Office of the Director of Laboratories (AFSC), and are made available to qualified organizations upon recommendation of AFSC Scientific and Technical Liaison Offices (STLOs) and subsequent approval of the Technical Objective Documents Board.

Technical Objectives range from general to specific in nature and contain information as to the state of the art and future possibilities. They also identify the Air Force laboratory personnel who may be contacted for more detailed information.

Establishment of Technical Objectives

Based upon our national military objectives, Headquarters, U.S. Air Force, provides broad program guidance for the entire Air Force. Using this guidance, Headquarters, Air Force Systems Command, describes systems concepts and high potential areas of research and development where progress is required to maintain aerospace superiority. In response to this guidance, plus inputs from other sources, the Air Force laboratories derive a set of technical goals. Each goal has been formalized under the title, "Technical Objective." These are then grouped by technical area into Technical Objective Documents, which form part of the overall plan to obtain the desired future Air Force operational capabilities.

The Purpose of TODs

The purpose of the TODs is to stimulate participation by scientific and industrial organizations in Air Force research and development programs by providing them with specific technical objectives toward which they can direct their research efforts.

TODs serve as a means of communication between the Air Force and American industry by providing the following services:

- Assistance in research and development planning.
- Broad technical guidance not normally available.
- Help in formulating relevant technical proposals.
- Assistance in recognizing internal programs which apply to Air Force needs.
- Aid in working with other government agencies.
- Aid to subcontractors in working with prime contractors.
- Identification of Air Force laboratory technical personnel having responsibility in specific technical areas.

Eligibility for the TOD Program

Eligible organizations include only those which have a sustained capability and a willingness to perform research and development as outlined in the TODs. In each case only those documents which cover technical areas in which the organization has a research and development capability will be released.

TODs are not authorized for release to the following categories:

- Professional societies, however, member organizations may apply individually for consideration.
- Organizations that are in the process of forming a business pool. Consideration will be given when the pool has been approved by the Small Business Administration.
- Organizations which are in financial difficulty or which have a poor reputation for business integrity.
- Organizations whose capabilities are based primarily upon those of consultants or part-time employees.

Each organization that desires TODs must establish a technical representative as a single point of contact to handle the documents. This point of contact is responsible for determining the overall needs of the organization and for obtaining and distributing the documents, as well as apprising all key executives, scientific and technical personnel in his organization of the Air Force TOD Program.

Area AFSC Scientific and Technical Liaison Offices (listed in Figure 1) are responsible for the conducting research and development capability surveys of organizations requesting TODs. Their findings and recom-

mendations are used as guidelines in approving or disapproving an organization's eligibility for receiving TODs.

Ultimate authority for approving all requests to participate in the TOD Program is vested in the Office of the Director of Laboratories (AFSC). The Laboratory Plans Office (SCTPL), Directorate of Laboratory Plans and Programs, Director of Laboratories, Headquarters, Air Force Systems Command, is responsible for the overall coordination and monitoring of the TOD Program, and also for establishing policies and procedures for releasing TODs.

Procedures for Requesting TODs

The first step in requesting participation in the Air Force TOD Program is to write to Headquarters, Air Force Systems Command (SCTPL), Andrews AFB, Washington, D. C. 20331, and determine if your organization is already participating. If the answer is yes, AFSC will provide the name of the individual who has been designated as the TOD contact point. If your organization is not participating, the necessary forms and instructions for initiating participation will be provided.

Security Requirements

Because some TODs are classified, appropriate clearance for receiving and storing security documents is required. When justified, however, an organization not having a security clearance or one of high enough level may be recommended for a security clearance or for upgrading of a current clearance in order to receive classified TODs. Such security clearances are initiated at Headquarters, Air Force Systems Command (SCTPL), subsequent to approval of an organization to receive classified TODs. Therefore, regardless of current security status, an organization should not hesitate to request all TODs considered applicable to its current research and development capability.

Distribution and Use of TODs

Automatic distribution of new TODs is not authorized. Prior to distribution of the new documents Headquarters, Air Force Systems Command, will request that all TOD recipients of the latest superseded documents verify their desire to receive

Air Force Systems Comand Scientific and Technical Liaison Offices (AFSC STLOs)

Area Office	Geographical Area of Responsibility
AFSC STLO (SCTL–1) 424 Trapelo Road Waltham Federal Center Waltham, Mass. 02154 Phone: (617) 894–2400 Ext. 331 or 332	Maine, New Hampshire, Vermont, Massachusetts and Rhode Island
AFSC STLO (SCTL–2) Room 222, O'Hare Office Center 3166 Des Plaines Ave. Des Plaines, Ill. 60018 Phone: (312) 299–1089	North Dakota, South Dakota, Nebraska, Minnesota, Iowa Wisconsin, Illinois, Indiana and Missouri
AFSC STLO (SCTL–3) Room 227, Federal Office Bldg. 1240 E. 9th St. Cleveland, Ohio 44199 Phone: (216) 522–5010 or 5011	Michigan, Ohio, Kentucky and Tennessee
AFSC STLO (SCTL–4) 500 S. Ervay St. Dallas, Tex. 75201 Phone: (214) 749–2025 or 2026	Mississippi, Kansas, Arkansas, Louisiana, Oklahoma, Texas and New Mexico
AFSC STLO (SCTL–5) 26 Federal Plaza New York, N. Y. 10007 Phone: (212) 264–0370 or 0371	New York, New Jersey, Connecticut and Pennsylvania
AFSC STLO (SCTL–6) Suite 104 363 S. Taafe Ave. Sunnyvale, Calif. 94086 Phone: (408) 245–9535 or 9536	Colorado, Wyoming, Utah, Nevada, Hawaii and that part of California north of the 36th parallel (approximately through Bakersfield)
AFSC STLO (SCTL–7) The Boeing Co. Seattle, Wash. 98124 Phone: (206) 655–5744	Alaska, Montana, Idaho, Washington and Oregon
AFSC STLO (SCTL–9) Department of the Navy Munitions Bldg. Washington, D. C. 20360 Phone: (202) 696–3594 or 5568	Delaware, Maryland, Virginia, District of Columbia, West Virginia, North Carolina, South Carolina, Georgia, Florida and Alabama
AFSC STLO (SCTL–10) Air Force Unit Post Office Los Angeles, Calif. 90045 Phone (213) 643–1621 or 1698	Arizona and that part of California south of the 36th parallel

Figure 1.

the new TODs. Should additional TODs be desired, other than those previously authorized, information regarding research and development in the additional areas must be furnished.

Old documents need not be returned before receiving new ones. When they have served their purpose, TODs are to be destroyed in accordance with paragraph 19 of the Industrial Security Manual for Safeguarding Classified Information. Duplicate certificates of destruction are not desired by Air Force Systems Command.

TODs will not be reproduced or disseminated outside the receiving organization without written permission of Headquarters, Air Force Systems Command.

Organizations which determine from a TOD that they can contribute to the achievement of a specific technical goal are invited to discuss the objective further with the scientist or engineer identified with that objective. New ideas not included in the TOD, which can make a significant contribution to military technology, are welcomed and encouraged.

TODs should not be considered the sole indication of Air Force technical interest. They should not confine but should stimulate thinking. Ideas and proposals for technical development, whether in reference to a TOD or not, are most welcome. These ideas may be submitted as unsolicited proposals in accordance with instructions outlined in the November 1968 issue of the *Defense Industry Bulletin*, page 24.

Following is a list of current Air Force TODs giving the document number, security classification, title and the responsible organization:

TOD 70–1 (Secret)
Advanced Weapons and Applications
Air Force Weapons Laboratory
Kirtland AFB, N. M. 87117

TOD 70–3 (Unclassified)
Aerospace Biotechnology
Aerospace Medical Division
Brooks AFB, Tex. 78235

TOD 70–4 (Unclassified)
Aerospace Vehicle Equipment
Air Force Flight Dynamics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–5 (Secret)
Avionic Communications
Air Force Avionics Laboratory
Wright-Patterson AFB, Ohio 45433

70–6 (Unclassified)
Bionics, Lasers, and Molecular Electronics
Air Force Avionics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–7 (Secret)
Chemical—Biological Munitions and Defense
Air Force Armament Test Laboratory
Eglin AFB, Fla. 32542

TOD 70–8 (Secret)
Conventional Munitions
Air Force Armament Test Laboratory
Eglin AFB, Fla. 32542

TOD 70–9 (Unclassified)
Power Generation
Air Force Aero-Propulsion Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–10 (Unclassified)
Aerospace Ground Support
Air Force Aero-Propulsion Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–11 (Secret)
Intelligence
Rome Air Development Center
Griffiss AFB, N. Y. 13440

TOD 70–12 (Unclassified)
Electromagnetic Reliability and Compatibility
Rome Air Development Center
Griffiss AFB, N. Y. 13440

TOD 70–14 (Secret)
Electromagnetic Transmission and Reception (below 15 GHz)
Rome Air Development Center
Griffiss AFB, N.Y. 13440

TOD 70–15 (Secret)
Electromagnetic Vehicle Enviroment, Camouflage, and Antennas
Air Force Avionics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–16 (Secret)
Electromagnetic Warfare
Air Force Avionics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–17 (Unclassified)
Flight Control
Air Force Flight Dynamics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–18 (Unclassified)
Flight Mechanics
Air Force Flight Dynamics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–19 (Unclassified)
Fuels, Lubrication, and Hazards
Air Force Aero-Propulsion Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–20 (Secret)
Ground-Based Surveillance
Rome Air Development Center
Griffiss AFB, N. Y. 13440

TOD 70–21 (Secret)
Ground Communications
Rome Air Development Center
Griffiss AFB, N. Y. 13440

TOD 70–22 (Unclassified)
Human Resources
Air Force Human Resources Laboratory
Brooks AFB, Tex. 78235

TOD 70–23 (Unclassified)
Information Displays
Rome Air Development Center
Griffiss AFB, N. Y. 13440

TOD 70–24 (Unclassified)
Information Processing
Rome Air Development Center
Griffiss AFB, N. Y. 13440

TOD 70–26 (Unclassified)
Materials
Air Force Materials Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–27 (Secret)
Navigation, Guidance, and Weapons Delivery
Air Force Avionics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–30 (Unclassified)
Electric Propulsion
Air Force Aero-Propulsion Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–31 (Unclassified)
Electromagnetic Propagation and Plasmas
Air Force Cambridge Research Laboratory
L. G. Hanscom Field, Mass. 01730

TOD 70–33 (Confidential)
Ramjet Propulsion
Air Force Aero-Propulsion Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–34 (Secret)
Aerospaceborne Reconnaissance and Surveillance
Air Force Avionics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–35 (Confidential)
Rocket Propulsion
Air Force Rocket Propulsion Laboratory
Edwards AFB, Calif. 93523

TOD 70–36 (Unclassified)
Structures
Air Force Flight Dynamics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–37 (Confidential)
Turbine Engine Propulsion
Air Force Aero-Propulsion Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–38 (Unclassified)
Vehicle Dynamics
Air Force Flight Dynamics Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–39 (Unclassified)
Terrestrial Environment
Air Force Cambridge Research Laboratory
L. G. Hanscom Field, Mass. 01730

TOD 70–40 (Unclassified)
Atmospheric Environment
Air Force Cambridge Research Laboratory
L. G. Hanscom Field, Mass. 01730

TOD 70–41 (Unclassified)
Space Environment
Air Force Cambridge Research Laboratory
L. G. Hanscom Field, Mass. 01730

TOD 70–42 (Secret)
Space Site Support
Air Force Aero-Propulsion Laboratory
Wright-Patterson AFB, Ohio 45433

TOD 70–43 (Unclassified)
Technical Facilities
Arnold Engineering Development Center
Aronold AFS, Tenn. 37389

Technical Performance

(Continued from page 3)

ard, other related technical management efforts going on in DOD which ODDR&E is trying to integrate are those on bid work statements, on the internal guidance to system engineering management needed to supplement the contract standard, and on system effectiveness analysis guides. The new DOD work breakdown structure and configuration management directives are also parts of this integration effort. All of these separate "building blocks" of a technical program management system must hang together. By acting as the focal point for all such efforts in the Office of the Secretary of Defense, ODDR&E is trying to help to assure that these efforts are, in fact, developed in a proper relationship to each other. ODDR&E feels that a set of agreed upon goals for the overall effort, a plan for satisfying these goals, and a scheduled application of the mix of resources (possibly industrial as well as DOD) are needed to implement this plan. It is of significance to note that, in recognition of the importance of building a sound foundation in this whole area of project/program technical control, the Director of Defense Research and Engineering has asked that this subject be one of the "Fundamental Problem Areas" for consideration by the Secretary of Defense's Industry Advisory Committee (IAC) in the immediate year ahead.

Summarizing the TPM aspects of the job, most people agree that research and development can be increasingly better planned as the program cycle proceeds. Since this is the case, it should be increasingly possible to validly measure progress against plans. This measurement, in turn, should identify deviations from plans and permit an assessment of what is happening and what needs to be done about it, not only in the technical area but in the cost and schedule areas as well. A mutual goal in this whole effort should be the earliest possible identification of foreseeable problems, together with an analysis of why things are going wrong, all of which is presented in a fashion which can readily be understood by management so that timely corrective action can be taken. As mentioned earlier, many industrial companies have taken major steps to improve their performance measurement systems and others are encouraged to do likewise. Significant progress can be made in the days ahead if both industry and the Defense Department, individually and collectively, apply themselves to this mutually beneficial task. There is admittedly a danger that, as they focus on measuring things, too much emphasis will come to be given to measuring the measurable, and that this, in turn, will come to make those things which are measurable the important aspects of a program in people's minds. However, if DOD and industry are both ever alert to this danger, the eventual value to be gained from good performance measurement will offset many fold the risk being taken.

Man's Underwater Capability Object of Navy Research

The Navy has launched a research project which promises to give additional knowledge about man's sensory behavior and speech performance in underwater operations.

Included in the project are plans to devise techniques of optimizing performance in sensory surveillance, as well as determining abilities in monitoring visual, auditory and tactual display.

Specific research has been designed to improve methods of using sensory skills not now used, and to select individuals who have special sensory skills for submarine duty.

Man's ability to speak effectively in underwater environment forms the second major area of research. Experiments are planned in speech production and reception in closed environments and undersea habitats.

Verbal communications among divers and swimmers, and the effects of water immersion on verbal behavior are also on tap for study.

The research program is being conducted by the Behavioral Science Division of the Submarine Medical Center, New London, Conn., in association with scientists at the University of Connecticut and Connecticut College.

NATO Establishes Industrial Advisory Group

The North Atlantic Treaty Organization (NATO) will establish an Industrial Advisory Group composed of four representatives from each member country.

Decision to form the advisory group was made during the NATO Conference of National Armament Directors and endorsed by the North Atlantic Council in Brussels, Belgium, on Oct. 14.

Purpose of the group will be to serve in an advisory role to the NATO Conference of National Armament Directors.

The group will also serve as a focal point for review and discussion of special studies and problems of industries which should be brought to NATO's attention.

Other functions of the group will be to improve the flow of information to and from industry in NATO countries; to provide discussion of research, development and production polices and practices as they affect industry; and to provide a forum to present significant problems to a cross-section of NATO industry.

First meeting of the Industrial Advisory Group will be held early in 1969 in Brussels, Belgium.

Each NATO member country will furnish a maximum of four industry representatives to attend each advisory group meeting. In addition, two senior government advisors from each country will attend.

To insure maximum participation, six industrial representatives have been named to serve as U.S. delegates to the Advisory Group meetings. The U.S. representatives were selected by the American Ordnance Association, National Security Industrial Association, Aerospace Industries Association, and Electronics Industry Association.

U.S. representatives are:

Elmer P. Wohl, Vice President, Administration, Aerospace & Systems Group, North American Rockwell Corp., 1700 E. Imperial Highway, El Segundo, Calif. 90246.

Forest W. Crowe, Vice President and General Manager, UNIVAC Federal Systems Div., Sperry Rand Corp., 2750 West 7th Blvd., St. Paul, Minn. 55116.

Ned B. McLean, Chairman of Edo Corp., 14–04 111 St., College Point, N.Y. 11356.

Willis M. Hawkins, Vice President Science and Engineering, Lockheed Aircraft Corp., 2555 N. Hollywood Way, Burbank, Calif. 91503.

Mansfield D. Sprague, Vice President Corporate Programs, American Machine & Foundry Co., 1701 K St., N.W., Washington, D.C. 20006.

Robert Kirk, Vice President, International Telephone & Telegraph Corp., 320 Park Ave., New York, N.Y. 10022.

Mr. McLean was elected as the first chairman of the U.S. group and Mr. Wohl was elected Vice Chairman. Mr. McLean, Mr. Hawkins and Mr. Kirk will serve for one year. Mr. Wohl, Mr. Sprague and Mr. Crowe have been named to the group for two years.

The U.S. representatives are sponsored by the Defense Department.

ILS Planning Guide Available to Contractors

An "Integrated Logistics Support Planning Guide for DOD Systems and Equipment" has been published by the Office of the Secretary of Defense. The Guide presents a systems engineering approach to the integration of support management with the other project management functions of design and production. It provides Service and contractor project managers with a basis for tailoring their own management planning of specific tasks during the development and acquisition of new weapons and equipment (see article, "Integrated Logistic Support, the Life Cycle Task of Support Management," *Defense Industry Bulletin*, June 1968 page 1).

The Guide is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $3.75. Military Service contract managers can obtain copies through their own departments.

Army Tests New Lightweight Bridge

Testing of the first production unit of a lightweight assault bridge that can be emplaced hydraulically in less than two minutes without exposure of personnel has been started by the Army.

The test bridge is the first of 29 production units being built by the Unit Rig and Equipment Co., Tulsa, Okla. Five of the units will be used for research, development and testing while the remaining bridges will be shipped to Vietnam for field evaluation.

Developed by the Army Mobility Equipment Research and Development Center at Fort Belvoir, Va., for use in the rice fields and swamps of Vietnam, the bridge is carried and launched by the M–113 armored personnel carrier.

The span is capable is supporting 15-ton loads over gaps up to 33 feet. Made of weldable aluminum alloy, it weighs 2,700 pounds and can be emplaced where heavier bridge equipment would bog down.

The bridge is carried in a folded position and can be emplaced or retrieved by hydraulic power from either end. Retrieval is performed by reversing the hydraulic connections.

An extruded orthotropic plate deck, rather than the traditional stringer floor beam design, is used in the construction of the bridge. This eliminates structural redundancies found in previous bridges and makes the roadway surface the primary load carrying member.

The cross-sectional configuration of the bridge is in the form of an open box, with two tapered sections hinged together to form one treadway. Two treadways are joined by bolted cross braces to form the roadway.

A double centered non-eccentric hinger, at the folding point of the two leaves of the bridge, provides a completely flush bottom flange when the bridge is in the open position. The folding mechanism includes a lightweight hydraulic cylinder with major aluminum components. The launching mechanism is a three-link mechanism, also constructed of an aluminum alloy, and pin-connected to the vehicle at six points.

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Organizations registered for service may obtain microfiche copies of these documents without charge from:
Defense Documentation Center
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All organizations may purchase microfiche copies (65¢) or full-size copies ($3) of the documents (unless otherwise indicated) from:
Clearinghouse for Federal and Scientific Information
Department of Commerce
Springfield, Va. 22151

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Distribution of Defense Procurement Circulars is made automatically by the U.S. Government Printing Office to subscribers of the Armed Services Procurement Regulation (ASPR).

Defense Procurement Circular No. 63, Sept. 30, 1968. (1) Competition and Price Representation in Small Purchases. (2) Cost Sharing Policy. (3) Providing Government Facilities to Contractors. (4) Utilization of Industrial Plant Equipment. (5) Organization and Publication of the ASPR. (6) Exchange of Sale of Personal Property. (7) Revision of DD Form 250. (8) Procurement Reporting. (9) Discounts Clause.

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The President has approved and nominated for Senate confirmation the following promotions as indicated:

Major General:

Brig. Gen. John L. Klingenhagen, Asst. Dep. Chief of Staff (Supply and Maintenance) Office of Dep. Chief of Staff (Logistics); **Brig. Gen. Walter J. Woolwine,** Dir. of Procurement, Army Materiel Command; **Brig. Gen. Hugh F. Foster Jr.,** Commanding General, Army Communications Systems Agency, Fort Monmouth, N.J.; **Brig. Gen. Albert E. Milloy,** Commanding General, John F. Kennedy Center for Special Warfare, Fort Bragg, N.C.; **Brig. Gen Francis P. Koisch,** Dir., Civil Works for Comprehensive Basin Planning, Office, Chief of Engineers; and **Brig. Gen. Robert B. Smith,** Chief of Public Information and Dep. Chief of Information, Office of Secretary of the Army.

Brigadier General:

Col. Stewart C. Meyer, Missiles & Space Directorate, Office of Chief of Research & Development; **Col. Richard C. Horne III,** White Sands Missile Range, N.M.; **Col. Donald V. Rattan,** John F. Kennedy Center for Special Warfare; **Col. George M. Bush,** Office, Under Secretary of the Army; **Col. George M. Snead Jr.,** Office, Asst. Chief of Staff (Communications-Electronics); and **Col. Edward M. Dooley,** Sentinel Systems Command, Huntsville, Ala.

Maj. Gen. Oren E. Hurlbut has been assigned as the new Commanding General, Army Weapons Command, Rock Island, Ill. He succeeds **Brig. Gen. W. J. Durrenberger.**

Col. Charles F. Frock is the new Dir., Ammunition Engineering Directorate, at Picatinny Arsenal, Dover, N.J.

Col. Robert A. Guenthner is the new Commanding Officer, Combat Support Group, Army Combat Developments Command, Fort Belvoir, Va.

Col. Robert C. Marshall, who has been nominated for promotion to brigadier general, has succeeded **Col. Hartsell H. Northington** as Dir., Site Activation Directorate, Sentinel System Command, Huntsville, Ala.

Col. Eduardo M. Soler has been assigned duty as Commanding Officer, Army Aviation Materiel Laboratories, Fort Eustis, Va. He succeeds **Col. Harry L. Bush,** who has been reassigned as Dep. Commander for Research, Engineering and Data, Army Aviation Materiel Command, St. Louis, Mo.

Walter W. Hollis has been appointed to a newly created position as scientific adviser to the Commanding General, Army Combat Developments Command Experimentation Command, Fort Ord, Calif.

DEPARTMENT OF THE NAVY

RAdm. Paul L. Lacy Jr. has been assigned duty as Future Submarine Design Project Manager, for the Naval Material Command.

RAdm. William J. Moran has been named Dir. of the Space Program Div., Office of the Chief of Naval Operations.

Brig. Gen. Jay W. Hubbard, USMC, has succeeded **Brig. Gen. F. E. Garretson, USMC,** as Dir. of Information, Headquarters, U. S. Marine Corps.

Capt. Frank W. Ewald is the new Commander, Naval Air Development Center, Johnsville, Pa.

Capt. W. L. Goldenrath succeeds **Capt. Roger Ireland** as Dir., Aerospace Crew Equipment Dept., Naval Air Engineering Center, Philadelphia, Pa.

Capt. Robert E. Vogel has assumed duties as Commanding Officer, Navy Subsistence Office, and Dep. Commander for Navy Food Service Programs, Naval Supply Systems Command.

Dr. Joel S. Lawson Jr. has been appointed as Dir. of Navy Laboratories by the Asst. Secretary of the Navy (Research & Development).

DEPARTMENT OF THE AIR FORCE

Col. Bernice S. Barr has been assigned as Executive, Air Force Special Weapons Center, Air Force Systems Command, Kirtland AFB, N.M.

Col. Donald W. Bowry is the new Chief of the Technical Requirements & Standards Office, Electronics Systems Div., Air Force Systems Command, L. G. Hanscom Field, Mass.

Col. Walter A. Brown Jr., has been named Chief, Contractor Administration Branch, Directorate of Procurement Policy, Office of Dep. Chief of Staff (Systems & Logistics), USAF Hq.

Col. Albert L. Guidera has been assigned as Chief, Configuration Management Div., (Minuteman), Space & Missile Systems Organization, Air Force Systems Command, Los Angeles, Calif.

Col. Perry L. Huie is the new Dir. of Planning and Technology at the Electronic Systems Div., Air Force Systems Command, L. G. Hanscom Field, Mass.

Col. Truman O'Keefe has been named Dir. of Civil Engineering, Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio.

The Air Force Missile Development Center, Holloman AFB, N.M., has a new Dir. of Materiel. He is **Col. Frank G. Uhring.**

Col. E. H. Vernon has been transferred to the Advanced Logistics Systems Center, Wright-Patterson AFB, Ohio, where he will serve as Chief of the Acquisition & Technical Management Systems Div. at the Air Force Logistic Command agency.

Col. Robert M. White has been named Dir. of the FX System Program Office, Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio.

KEY PERSONNEL CHART

OFFICE OF THE CHIEF OF NAVAL OPERATIONS, WASHINGTON, D. C.

AND SUBORDINATES

Telephone (202) OXford plus extension

CHIEF OF NAVAL OPERATIONS

(OP-00)
ADM T H MOORER 4E660 56007
CAPT J J LeBourgeois 4E672 55664
(Exec Asst & Sr Aide) (OP-002)

VICE CHIEF OF NAVAL OPERATIONS
(OP-09)
ADM B A CLAREY 4E644 78347
CAPT T F Dedman 4E636 59955
(Exec Asst & Sr Aide) (OP-09A)

NAVAL SECURITY GROUP COMMAND HEADQUARTERS

(Naval Security Station)
RADM R E COOK 17-137 60444
(Commander NAVSECGRUCOM)
DEPUTY COMMANDER
CAPT J W Pearson 17-137 60444

BUREAU OF MEDICINE & SURGERY

(Potomac Annex)
VADM R B BROWN (MC) (Chief) 1112 62277
(Surgeon General)
DEPUTY CHIEF OF BUREAU
RADM G M Davis (MC) 1112 62278

BUREAU OF NAVAL PERSONNEL

(Arlx)
VADM C K DUNCAN 2072 41101
(Chief of Naval Personnel)
CAPT D A Smith 2077 42340
(Executive Assistant & Senior Aide)
DEPUTY & ASST CHIEF OF BUREAU
RADM M F Weisner 2070 42243

MILITARY SEA TRANSPORTATION SERVICE HEADQUARTERS

(T-8)
VADM LAWSON P RAMAGE 1004 69221
(Commander MSTS)
DEPUTY COMMANDER & CHIEF OF STAFF
RADM John M Alford 1002 69214

ASST VCNO/DIR OF NAV ADMIN

(OP-09B)
RADM P E HARTMANN 4E623 54337

HEADQUARTERS, NAVAL MATERIAL COMMAND

CHIEF OF NAVAL MATERIAL
(Main Navy)
ADM I J GALANTIN 2010 68500
CAPT W G Lessman 2010 65235
(Exec Asst & Sr Aide) (MAT 00B)
CDR F R Talbot 2010 68525
(Pers Aide) (MAT 00A)

VICE CHIEF OF NAVAL MATERIAL
RADM J D Arnold 2010 68548
CDR E D McKellar 2010 65235
(Exec Asst) (MAT 09B)

OFFICE OF THE OCEANOGRAPHER OF THE NAVY

(Madison Bldg, Alex. Va.)
RADM O D WATERS JR Mad Bg 56002
(Oceanographer of the Navy)
ASST OCEANOGRAPHER FOR OCEAN SCIENCE
RADM T B Owen MN 0449 64911
ASST OCEANOGRAPHER FOR OCEAN ENGINEERING & DEVELOPMENT
RADM A S Goodfellow MN 2018 64850
SPECIAL ASST FOR RDT&E
CAPT F J Ruder Mad Bg 71741
PUBLIC AFFAIRS OFFICE
Mr M MacBain Mad Bg 74179
OCEAN CENTER
Mr F Small Mad Bg 70786
PROGRAMS DIV
CAPT J E Ayres (Dir) Mad Bg 71741
REQUIREMENTS DIV
CAPT R W Haupt (Dir) Mad Bg 70352
PLANS & POLICY DIV
CAPT L B Sisson (Dir) Mad Bg 72565
FINANCIAL MANAGEMENT DIV
CDR E Ford (Dir) Mad Bg 59334

NAVAL WEATHER SERVICE COMMAND HEADQUARTERS

(Bg 200 WNY)
CAPT E T HARDING 3100 32701
(Commander NAVWEASERVCOM)
DEPUTY COMMANDER
CAPT M A Eaton 3101 32704

NAVAL INTELLIGENCE COMMAND HEADQUARTERS

RADM F J HARLFINGER 5C572 53239
(Commander NAVINTCOM)
CAPT F M Murphy 5C564 52988

NAVAL COMMUNICATIONS COMMAND HEADQUARTERS

RADM F J FITZPATRICK 4C677 57284
(Commander NAVCOM)
DEPUTY COMMANDER
CAPT E H Farrell BXR 44701
ASST COMMANDER (PLANS PROGRAMS & REQS)
CAPT W N Cone BXR 44739
ASST COMMANDER (OPS & READINESS)
CDR O G Baird BXR 44705
ASST COMMANDER (MAT REQS & READINESS)
CAPT B Q Ryan BXR 44727
ASST COMMANDER (FAC REQS & READINESS)
CAPT J A Burfield BXR 44769
ASST COMMANDER (RADIO FREQ & ELECT COMPAT)
CAPT D C Brumbaugh NAVSECSTR 60880
ASST COMMANDER (COMM SYS PLANNING)
CAPT L F Ashley BXR 44394

DCNO (MANPOWER AND NAVAL RESERVE) (OP-01)

VADM C K DUNCAN 4E474 55588
ADCNO (MANPOWER) (OP-01B)
RADM B H Shupper 4E474 55517
MANPOWER DIVISION (OP-10)
CAPT V V Eason Jr (Director) 4E474 75744
ADCNO (NAVAL RESERVE) (OP-01R)
RADM J T BURKE 4E466 52757
NAVAL RESERVE PLANS DIV (OP-11)
CAPT E M Greer Jr (Director) 4E466 52858

DCNO (LOGISTICS) (OP-04)

VADM R L SHIFLEY 4E606 52154
ADCNO (LOGISTICS) (OP-04B)
RADM E B Hooper 4E606 55183
INSPECTION & SURVEY MATTERS (OP-04C)
RADM J D Bulkeley Arlx 2404 43602
(Executive for)
LOGISTICS PLANS DIVISION (OP-40)
RADM F B Gilkeson (Director) 4B546 54001
MATERIEL DIVISION (OP-41)
CAPT J B Kaye (Director) 4B545 54003
INTERNATIONAL LOGISTICS DIVISION (OP-42)
CAPT S S Leon (Director) 4B539 56071
SHIPS MATERIAL READINESS DIVISION (OP-43)
RADM E A Grantham 4A486 77030
SHORE INSTALLATIONS DIVISION (OP-44)
RADM F E Janney (Director) 4B473 52420

DCNO (PLANS AND POLICY) (OP-06)

RADM F J BLOUIN 4E588 53707
ADCNO (PLANS AND POLICY) (OP-06B)
RADM A F Fleming 4E588 79946
ASST FOR WAR GAMING MATTERS (OP-06C)
CAPT C E Hunter 5E531 76477
STRATEGIC PLANS & POLICY DIVISION (OP-60)
RADM F H Schneider Jr (Dir) 4E566 55620
RADM G C Talley Jr (Asst Dir) 4E566 54402
POLITICO-MILITARY POLICY DIV (OP-61)
RADM J P Weinel (Dir) 4E572 52453
PAN AMERICAN AFFAIRS, NAVAL MISSIONS & ADVISORY GROUPS DIV (OP-62)
RADM G R La Rocque (Director) 4E542 53835
FOREIGN MILITARY ASSISTANCE DIV (OP-63)
CAPT G M Hagerman (Director) 4E524 72411

DCNO (FLT OPS & READ) (OP-03)

VADM J B COLWELL 4E552 77469
ADCNO (FLT OPS & READ) (OP-03B)
RADM R E Riera 4E552 54611
PROGRAM COORD DX/DXG (OP-03D)
RADM T R Weschler MN 3426 68751
FAST DEPLOYMENT LOGISTICS SHIP PROJECT (FDL) (OP-03F)
CAPT E A Lane Bg 9 Qtrs K 43528
(Program Director)
ANTI-SHIP MISSILE DEFENSE PROGRAM COORDINATOR (OP-03G)
RADM J E Dacey 4B484 74380
SSN PROGRAM COORD (OP-03N)
RADM P A Beshany 4C600 54127
CVA (N) PROGRAM COORDINATOR (OP-03V)
RADM J L Holloway III 4E731 78767
SOUTHEAST ASIA COMBAT ANALYSIS GROUP (OP-03Z)
CAPT G F Colleran 4E408 55536
PROGRAMS & PLANS DIV (OP-30)
CAPT J T Alexander (Dir) 4D483 55006
SUBMARINE WARFARE DIV (OP-31)
RADM P A Beshany (Dir) 4C600 54127
ANTISUBMARINE WARFARE & OCEAN SURVEILLANCE DIV (OP-32)
RADM L J O'Brien Jr (Dir) 4C628 74783
FLEET OPERATIONS DIVISION (OP-33)
RADM J C Donaldson Jr 4D600 76033
STRIKE WARFARE DIV (OP-34)
RADM R M Isaman (Dir) 4D547 54331
ELECTRONIC WARFARE AND TACTICAL COMMAND SYSTEMS DIVISION (OP-35)
RADM M D Carmody (Dir) 4C469 57642
SHIP CHARACTERISTICS DIVISION (OP-36)
RADM T R Weschler (Dir) 4A526 76897
FLEET READINESS & TRAINING DIVISION (OP-37)
RADM T S King Jr (Dir) Malvern Bg 59091

DCNO (AIR) (OP-05)

VADM T F CONNOLLY 4E394 52374
ADCNO (AIR) (OP-05B)
RADM F H Michaelis 4E394 52629
ADCNO (MARINE AVIATION) (OP-05M)
MAJGEN K B McCutcheon USMC Arlx 2313 41023
AVIATION PLANS & REQUIREMENTS DIV (OP-50)
RADM G E Miller (Dir) 4E384 71446
AVIATION PROGRAMS DIVISION (OP-51)
RADM J M James (Dir) 4E391 75507
FLIGHT OPERATIONS DIV (OP-53)
CAPT G E Lambert (Dir) Malvern Bg 76217
AVIATION TRAINING DIVISION (OP-56)
CAPT J M Thomas (Dir) 4D371 53409

DCNO (DEVELOPMENT) (OP-07)

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ADCNO (DEVELOPMENT) (OP-07B)
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DEVELOPMENT PLANNING DIVISION (OP-70)
CAPT R C Gillette (Director) 5C722 52920
UNDERSEA & STRATEGIC WARFARE DEVELOPMENT DIVISION (OP-71)
RADM P B Armstrong (Director) 5C663 52965
AIR, SURFACE, & ELECTRONICS WARFARE DIVISION (OP-72)
RADM J K Beling (Director) 5C675 52865
ATOMIC ENERGY DIV (OP-75)
CAPT J G Whiteaker (Director) 5D816 52143
NAVY SPACE PROGRAM (OP-76)
(Director) 5D768 53971
TECHNICAL ANALYSIS & ADVISORY GP (OP-07T)
Dr R O Burns (Director) 5C678 57633

DIRECTOR, NAVY PROGRAM PLANNING (OP-090)

VADM F G BENNETT 4E614 52688
GENERAL PLANNING & PROGRAMMING DIVISION (OP-90)
RADM C E Bell Jr (Dir) 4D666 70517
INFORMATION SYSTEMS DIVISION (OP-91)
RADM R W Paine Jr 2C337 77255
LONG RANGE OBJECTIVES GROUP (OP-93)
RADM E P Aurand (Dir) 4A720 52758
SYSTEMS ANALYSIS DIVISION (OP-96)
RADM J B Davis Jr (Director) 4A686 70831

DIRECTOR, ASW PROGRAMS (OP-95)

VADM T F CALDWELL JR 5D569 73408
RADM E W Dobie Jr 5D569 74587
(Dep Dir) (OP-95B)

DIRECTOR, OFFENSIVE & DEFENSIVE SYSTEMS (OP-97)

RADM G H MILLER 4E438 75405

ACNO (INTELLIGENCE) (OP-92)

RADM F J HARLFINGER 5C572 53239

ACNO (COMMUNICATIONS & CRYPTOLOGY) (OP-94)

RADM F J FITZPATRICK 4C677 57284

NAVAL INSPECTOR GENERAL (OP-008)

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RADM R F Dubois Arlx 1046 43127
(Dep Naval Inspector Gen) (OP-008B)

DIRECTOR SPECIAL STUDIES AND PRESENTATIONS GROUP (OP-09D)

CAPT L C McCarty 5D558 78361

EDITOR'S NOTE:

Because of inadvertent omission of some key elements of the Navy Department organization chart, published in the November 1968 issue of the Defense Industry Bulletin, a portion is being reprinted in this issue.

Organizations charts appearing in the Bulletin are edited by the editorial staff to reflect those elements of the various DOD organizations which are of interest to industry representatives. Organizational elements not involved in the DOD-industry relationship have been eliminated because of space limitations.

The information on personnel, room and telephone numbers is as current as is possible to obtain at the time we go to press. Basic information in this chart was extracted from the Key Personnel Chart of the Department of the Navy Washington Headquarters, dated Sept. 15, 1968, and is updated insofar as was possible.

Army Aviation Materiel Command Reorganized and Renamed

The U.S. Army Aviation Materiel Command (AVCOM), headquartered in the Mart Building at 12th and Spruce Streets, St. Louis, Mo., has been reorganized and renamed. The new name is the U.S. Army Aviation Systems Command (AVSCOM).

Under the command of Major General John Norton, AVSCOM is responsible for the design, production and maintenance of Army aircraft. This responsibility includes the research and initial development of a new aircraft type, the testing of the new equipment, contracting for its production, providing repair parts and maintenance assistance to the field army, and providing international logistical support to other countries which use the same types of aircraft as the U.S. Army.

Under the new AVSCOM organization, the technical operations have been separated from the staff and supporting elements:

• Deputy Commanding General and Chief of Staff, Brigadier General John P. Traylor, is responsible for staff and supporting functions such as personnel, comptroller, automatic data processing, legal and facilities management.

• Deputy Commander for Research, Engineering and Data, Colonel Harry L. Bush, also commands the AVSCOM Research, Engineering and Data Activity which is responsible for the entire scope of aviation engineering, to include research at the Aviation Materiel Laboratories, Fort Eustis, Va., and flight testing at the Aviation Systems Test Activity, Edwards AFB, Calif. His organization also provides engineering support for aircraft already deployed in the field.

• Deputy Commander for Acquisition, Colonel Clifton O. Duty, also commands the AVSCOM Acquisition Activity which is responsible for the procurement and production of aircraft, engines, repair parts and services, and for assuring that quality standards established for the equipment are met.

• Deputy Commander for Logistics Support, Colonel Delbert L. Bristol, also commands the AVSCOM Logistics Support Activity which is responsible for the logistical support of Army aircraft in the field, providing repair parts, maintenance assistance, technical manuals, and for determining the requirements to support future operations. His maintenance responsibilities include command of the U.S. Army Aeronautical Depot Maintenance Center, Corpus Christi, Tex., which maintains and overhauls turbine engines and all types of Army aircraft.

The new organization is expected to provide a greater capability for intensive management of Army aircraft systems throughout their life span. Major benefits should be derived in terms of improved support of combat forces and more efficient development and procurement.

Air Force Invites FX Proposals

The Air Force has invited eight aircraft companies to submit proposals for contract definition of an advanced tactical fighter aircraft designated the FX.

The FX program calls for the acquisition of a highly maneuverable, single place, twin-engine jet fighter with initial operational capability in the mid-1970s.

Initial engine development contracts for the FX were announced Aug. 27. First flight of the new aircraft is expected in 1972.

Primary mission of the FX will be to achieve and maintain air superiority. The plane will have significantly better air-to-air performance than any known fighter aircraft.

Companies invited to submit proposals are: The Boeing Co., Seattle, Wash.; Fairchild-Hiller Corp., Farmingdale, N.Y.; General Dynamics Corp., Fort Worth, Tex.; Grumman Aircraft Engineering Corp., Bethpage, N.Y.; Lockheed Aircraft Corp., Burbank, Calif.; McDonnell-Douglas Corp., St. Louis, Mo.; North American Rockwell Corp., Los Angeles, Calif.; and Northrop Corp., Hawthorne, Calif.

Navy Annual Oceanography Symposium Set

The Sixth Annual U.S. Navy Symposium on Military Oceanography will be held May 26–28, 1969, at the Seattle Center Playhouse, in Seattle, Wash.

The three-day meeting will feature some of the nation's leading oceanographers from industry, the academic community, the Military Services and the Federal Government.

Host for the symposium will be Dr. J. E. Henderson, Director of the Applied Physics Laboratory at the University of Washington.

Invitations to present papers and applications for attendance will be issued in January 1969. Information concerning the symposium can be obtained by contacting the Office of the Oceanographer of the Navy, (Attn: Code N812), 732 N. Washington St., Alexandria, Va. 22314; or Dr. J. E. Henderson, Applied Physics Laboratory, University of Washington, Seattle, Wash. 98105.

The symposium is sponsored annually by the Oceanographer of the Navy. The 1968 meeting was held in Panama City, Fla.

Army Establishes New Research Unit

The U.S. Army Combat Developments Command (CDC), Fort Belvoir, Va., has provisionally formed a new element to perform research in matters of civil affairs, psychological operations, stability operations, and unconventional warfare.

Called the Institute of Strategic and Stability Operations, the new unit will be headquartered at Fort Bragg, N.C., under the command of Colonel Francis J. Kelly.

The new unit was formed by combining the former Special Warfare Agency, Fort Bragg, with the Civil Affairs Agency, Fort Gordon, Ga. The civil affairs element of the institute will continue to collocate with the Civil Affairs School at Fort Gordon.

Special emphasis will be given by the institute to low intensity conflict including military assistance and advisory efforts.

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News Items Subject Index

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PROCUREMENT

PUBLICATIONS

RESEARCH AND DEVELOPMENT

SHIP BUILDING

SMALL BUSINESS

Status of Funds Quarterly Report

Expenditures

Fourth Quarter, Fiscal Year 1968

(Thousands of Dollars)

Department of Defense	Expenditures				Unpaid obligations	
	April 1968	May 1968	June 1968	Cum thru June 30, 1968	At start of year	As of June 30, 1968
Military Personnel						
Active forces	1,668,809	1,700,553	1,937,242	18,987,619	850,076	761,917
Reserve forces	60,912	70,740	88,177	871,425	149,863	149,746
Retired pay	184,700	185,719	187,030	2,094,746	7,622	6,880
Undistributed	−24,342	91,887	−44,966	—	—	—
Total—Military Personnel	1,890,078	2,048,898	2,167,482	21,953,789	1,007,561	918,543
Operation and Maintenance	1,731,488	1,709,957	2,249,622	20,577,826	[a] 3,542,486	4,033,198
Procurement						
Aircraft	810,391	728,963	748,202	9,466,788	[a] 9,317,974	9,591,226
Missiles	193,718	185,947	215,288	2,228,495	1,929,015	2,069,735
Ships	214,848	−83,418	106,368	1,355,851	3,049,781	3,447,418
Tracked combat vehicles	35,954	54,506	49,913	482,544	632,680	610,190
Ordnance, vehicles, and related equipment	516,374	595,452	883,740	6,396,808	6,721,730	6,595,367
Electronics and communications	140,228	156,260	198,252	1,620,299	1,998,176	1,881,334
Other procurement	133,362	203,296	105,056	2,110,765	1,947,502	2,056,183
Undistributed	64,317	−232,972	−266,115	−378,831	−386,056	−7,225
Total—Procurement	2,109,192	1,608,031	2,040,705	23,282,719	25,210,802	26,244,228
Research, Development, Test, and Evaluation						
Military sciences	86,989	67,856	91,737	1,013,363	867,381	77,774
Aircraft	117,564	279,698	109,104	1,366,679	796,125	717,451
Missiles	198,647	200,551	174,503	2,488,374	1,095,907	983,018
Astronautics	96,677	103,888	124,960	1,220,757	649,793	487,480
Ships	20,977	10,309	15,175	272,170	212,773	245,279
Ordnance, vehicles, and related equipment	33,549	30,793	24,036	350,168	235,442	216,577
Other equipment	68,789	67,921	73,243	783,501	541,757	478,981
Program-wide management and support	30,405	30,560	29,016	444,766	163,038	189,338
Undistributed	−28,509	−109,598	−41,545	−192,399	−194,032	−1,633
Total—Research, Development, Test, & Eval.	625,088	681,978	600,228	7,747,380	4,368,185	4,094,265
Military Construction	97,123	138,221	77,188	1,281,339	1,581,256	1,784,255
Family Housing	43,819	44,744	36,526	494,903	114,964	174,687
Civil Defense	9,016	10,638	7,330	107,637	91,893	80,629
Other—Special Foreign Currency Program	66	−2	445	1,724	2,193	1,071
Revolving and Management Funds	336,598	669,506	98,519	2,089,944	8,440,858	6,077,121
Subtotal—Military Functions	6,842,468	6,911,967	7,278,049	77,537,260	[b] 44,360,197	[b] 43,407,998
Military Assistance	63,336	73,982	89,491	600,926	2,112,357	1,823,034
TOTAL—DEPARTMENT OF DEFENSE	6,905,803	6,985,949	7,367,540	78,138,186	[b] 46,472,554	[b] 45,231,032

Department of the Army	April 1968	May 1968	June 1968	Cum thru June 30, 1968	At start of year	As of June 30, 1968
Military Personnel						
Active forces	778,029	688,828	892,403	7,765,096	392,872	382,077
Reserve forces	36,427	46,608	59,353	567,026	112,152	112,578
Undistributed	−6,111	66,127	−21,535	—	—	—
Total—Military Personnel	808,345	801,563	930,221	8,332,122	505,024	494,654
Operation and Maintenance	697,720	698,304	1,052,579	8,204,779	1,252,029	1,541,708
Procurement						
Aircraft	112,269	102,562	106,212	1,144,536	1,303,735	1,343,518
Missiles	32,763	36,781	64,714	403,602	458,264	629,712
Tracked combat vehicles	35,667	54,257	47,715	477,416	611,133	586,046
Ordnance, vehicles, and related equipment	158,190	285,902	385,737	2,854,559	3,387,912	3,445,481
Electronics and communications	46,447	65,959	110,844	653,877	780,554	688,774
Other procurement	67,050	75,485	−30,444	685,852	817,300	769,510
Undistributed	60,796	−233,688	−243,888	−378,831	−386,056	−7,225
Total—Procurement	513,182	387,258	440,890	5,841,011	6,972,842	7,455,816
Research, Development, Test, and Evaluation						
Military sciences	11,722	10,864	13,138	154,520	133,665	98,272
Aircraft	7,629	8,714	7,667	130,558	85,463	78,199
Missiles	57,814	67,481	84,814	717,837	435,876	386,366
Astronautics	1,067	1,260	1,167	17,784	15,069	7,865
Ordnance, vehicles, and related equipment	11,822	20,211	16,133	187,152	136,432	110,532
Other equipment	28,740	29,299	42,707	337,306	218,437	196,748
Program-wide management and support	9,391	4,877	5,198	81,338	39,835	33,898
Undistributed	−28,663	−110,715	−45,036	−192,399	−194,032	−1,633
Total—Research, Development, Test, & Eval	99,522	31,992	125,787	1,434,096	870,745	910,247
Military Construction	46,220	87,206	26,823	677,986	818,076	768,046
Revolving and Management Funds	128,534	298,672	−104,081	804,241	2,892,551	1,954,616
TOTAL—DEPARTMENT OF THE ARMY	2,293,523	2,304,992	2,472,222	25,294,236	13,311,268	13,125,087

[a] Differs from amounts reported June 30, 1967, due to reclassification of Aircraft and Related Procurement, Navy from "Procurement" to "Operation and Maintenance." Amount $37,300 thousand.

[b] Differs from prior reports due to inclusion of gross unpaid obligations for Stock and Industrial Funds not previously reflected in this report.

NOTE: Detail may not add to rounded totals.

Department of the Navy	Expenditures				Unpaid obligations	
	April 1968	May 1968	June 1968	Cum thru June 30, 1968	At start of year	As of June 30, 1968
Military Personnel						
Active forces	413,687	549,408	538,085	5,567,072	232,405	225,093
Reserve forces	13,545	12,860	15,682	153,790	19,698	22,898
Undistributed	−15,858	8,310	−7,489	—	—	—
Total—Military Personnel	411,374	570,578	546,278	5,720,862	252,103	247,991
Operation and Maintenance	408,192	408,826	548,762	5,164,016	[a] 1,234,696	1,466,352
Procurement						
Aircraft	276,833	262,068	273,808	3,243,717	[a] 3,505,672	3,218,049
Missiles	41,878	40,759	19,056	437,053	470,557	547,934
Ships	214,848	−83,418	106,368	1,355,851	3,049,781	3,447,418
Tracked combat vehicles	287	249	2,198	5,128	21,547	24,144
Ordnance, vehicles, and related equipment	147,482	150,850	156,979	1,617,583	1,611,746	1,713,934
Electronics and communications	51,520	57,616	49,516	526,072	656,377	645,301
Other procurement	3,740	75,293	62,923	806,261	921,116	1,143,225
Undistributed	2,073	−5,357	−9,627	—	—	—
Total—Procurement	738,659	498,061	661,221	7,991,665	10,236,796	10,740,005
Research, Development, Test, and Evaluation						
Military sciences	14,291	3,895	14,487	181,703	127,323	121,458
Aircraft	25,602	16,105	22,332	315,298	260,838	257,524
Missiles	55,775	59,841	11,858	808,668	293,783	258,025
Astronautics	1,448	−3,333	500	16,042	12,677	16,259
Ships	20,977	10,309	15,175	272,170	212,773	245,279
Ordnance, vehicles, and related equipment	21,727	10,582	7,903	163,016	99,010	106,045
Other equipment	11,126	14,400	7,754	133,196	89,328	79,604
Program-wide management and support	662	6,454	4,402	112,534	97,989	133,064
Undistributed	−48	1,659	4,479	—	—	—
Total—Research, Development, Test, & Eval.	151,560	119,912	88,890	2,002,627	1,193,721	1,217,258
Military Construction	11,244	11,789	16,094	92,967	269,300	573,575
Revolving and Management Funds	119,508	381,369	253,326	1,134,184	3,234,657	2,269,078
TOTAL—DEPARTMENT OF THE NAVY	1,840,535	1,990,533	2,114,571	22,106,321	16,421,272	16,514,258

Department of the Air Force

	April 1968	May 1968	June 1968	Cum thru June 30, 1968	At start of year	As of June 30, 1968
Military Personnel						
Active forces	477,093	462,317	506,754	5,655,451	224,799	154,747
Reserve forces	10,940	11,272	13,142	150,609	18,013	14,270
Undistributed	−2,373	17,449	−15,941	—	—	—
Total—Military Personnel	485,660	491,038	503,955	5,806,060	242,812	169,017
Operation and Maintenance	538,701	520,024	561,129	6,211,171	955,856	927,881
Procurement						
Aircraft	421,289	364,333	368,182	5,078,535	4,508,567	5,029,659
Missiles	119,077	108,407	131,518	1,387,840	1,000,194	892,089
Ordnance, vehicles & related equipment	210,623	158,473	339,955	1,920,525	1,719,842	1,434,835
Electronics and communications	41,799	31,712	37,162	432,925	555,915	539,008
Other procurement	60,635	49,440	70,890	587,864	164,740	100,001
Undistributed	1,316	6,311	−12,658	—	—	—
Total—Procurement	854,739	718,674	935,050	9,407,689	7,949,258	7,995,592
Research, Development, Test, and Evaluation						
Military sciences	13,351	14,088	13,525	166,928	131,619	104,162
Aircraft	84,333	254,879	79,105	920,823	449,824	381,728
Missiles	85,058	73,229	77,831	961,869	366,248	338,627
Astronautics	94,162	105,961	123,293	1,186,931	622,047	463,356
Other equipment	28,923	24,222	22,782	312,999	233,992	202,629
Program-wide management and support	20,352	19,229	19,416	250,894	25,214	22,376
Undistributed	202	−542	−988	—	—	—
Total—Research, Development, Test & Eval.	326,381	491,066	334,964	3,800,444	1,828,944	1,512,878
Military Construction	38,883	38,178	33,518	492,064	473,206	425,858
Revolving and Management Funds	88,659	49,658	−58,667	74,625	441,102	521,170
TOTAL—DEPARTMENT OF THE AIR FORCE	2,333,026	2,308,635	2,309,951	25,792,054	11,891,177	11,552,396

[a] Differs from amounts reported June 30, 1967, due to reclassification of Aircraft and Related Procurement, Navy from "Procurement" to 'Operation and Maintenance." Amount $37,300 thousand.

Defense Agencies/Office of the Secretary of Defense	Expenditures April 1968	May 1968	June 1968	Cum thru June 30, 1968	Unpaid obligations At start of year	As of June 30, 1968
Military Personnel						
Retired pay	184,700	185,719	187,030	2,094,746	7,622	6,880
Operation and Maintenance	86,875	82,804	87,153	997,860	99,905	97,258
Procurement						
Ordnance, vehicles, and related equipment	79	227	1,069	4,141	2,230	1,117
Electronics and communications	462	973	730	7,425	5,330	8,251
Other procurement	1,937	3,078	1,687	30,788	44,346	43,447
Undistributed	132	—238	58	—	—	—
Total—Procurement	2,611	4,040	3,544	42,354	51,906	52,815
Research, Development, Test, and Evaluation						
Military sciences	47,625	39,009	50,587	510,212	474,774	453,882
Military Construction	777	1,049	752	18,322	20,674	16,777
Family Housing	43,819	44,744	36,526	494,903	114,964	174,687
Other—Special Foreign Currency Program	66	−2	445	1,724	2,193	1,071
Revolving and Management Funds	−104	−60,192	7,940	76,894	1,872,548	1,332,258
TOTAL—DEFENSE AGENCIES/OSD	366,368	297,170	373,975	4,237,013	2,644,586	2,135,628

Office of Civil Defense

Civil Defense	9,016	10,638	7,330	107,637	91,893	80,629
Revolving and Management Funds	—	—	—	—	—	—
TOTAL—OFFICE OF CIVIL DEFENSE	9,016	10,638	7,330	107,637	91,893	80,629

Military Assistance

Military Personnel	22	17	18	271	525	353
Operation and Maintenance	24,080	21,702	27,624	257,534	289,568	230,840
Procurement						
Aircraft	7,757	7,775	8,444	82,091	235,101	226,880
Missiles	−980	356	1,454	5,349	23,650	16,035
Ships	590	25,392	755	43,362	114,450	43,984
Ordnance, vehicles, and related equipment	14,008	12,880	24,295	125,297	264,633	192,738
Electronics and communications	5,613	3,115	6,942	45,131	132,402	101,235
Other procurement	9,142	6,102	8,807	54,254	127,226	88,420
Total—Procurement	36,130	55,620	50,697	355,484	897,462	669,292
Research, Development, Test, and Evaluation	—	−38	−1	−1,019	401	35
Military Construction	238	—	241	3,182	171,824	6,809
Revolving Fund	4,207	−1,948	−7,348	−17,746	764,607	848,233
Undistributed	−1,340	−1,370	18,259	3,220	−12,030	67,472
TOTAL—MILITARY ASSISTANCE	63,336	73,982	89,491	600,926	2,112,357	1,823,034

Obligations

Department of Defense	Available for obligation	Obligations April 1968	May 1968	June 1968	Cum thru June 30, 1968	Unobligated balance June 30, 1968
Military Personnel						
Active forces	19,291,780	1,622,424	1,640,115	1,706,639	19,277,720	14,060
Reserve forces	924,671	59,832	74,308	121,921	876,635	48,036
Retired pay	2,095,000	184,568	185,675	187,508	2,093,478	1,522
Total—Military Personnel	22,311,451	1,866,825	1,900,096	2,016,069	22,247,833	63,618
Operation and Maintenance	23,035,127	1,932,210	1,806,663	2,959,526	22,990,259	44,870
Procurement	13,529,768	869,842	1,106,795	1,767,270	10,145,973	3,383,795
Missiles	3,133,694	240,491	110,527	252,152	2,489,109	644,585
Ships	4,763,125	90,859	258,387	378,578	1,869,376	2,893,749
Tracked combat vehicles	561,207	53,767	27,302	116,255	471,693	89,514
Ordnance, vehicles and related equipment	9,539,673	568,328	418,653	964,414	7,771,487	1,768,186
Electronics and communications	2,389,388	139,511	123,191	379,590	1,614,698	774,690
Other procurement	3,377,786	276,303	262,728	378,368	2,518,256	859,533
Undistributed	286,648	—	—	—	—	286,648
Total—Procurement	37,581,290	2,239,097	2,307,579	4,236,632	26,880,592	10,700,698
Research, Development, Test, & Evaluation						
Military sciences	1,141,124	55,282	88,682	127,486	992,312	148,812
Aircraft	1,421,470	86,306	63,731	127,223	1,293,218	128,252
Missiles	2,526,622	93,806	95,702	164,234	2,465,925	60,697
Astronautics	1,238,546	133,787	69,472	98,250	1,166,202	72,344
Ships	373,327	20,490	26,947	34,690	324,179	49,148
Ordnance, vehicles, and related equipment	399,145	16,113	16,133	46,277	341,773	57,372
Other equipment	935,070	50,006	49,810	93,103	743,614	191,456
Program-wide management and support	739,103	56,356	52,986	94,921	673,166	65,937
Emergency Fund	—	—	—	—	—	—
Undistributed	84,931	—	—	—	—	84,931
Total—Research, Development, Test, & Eval.	8,859,338	512,144	463,465	786,183	8,000,388	858,950
Military Construction	3,376,956	126,289	292,659	436,621	1,784,359	1,592,598
Family Housing	873,745	56,153	52,681	70,277	645,127	228,618
Civil Defense	108,561	5,032	7,345	19,718	100,134	8,427
Other	72,576	159	276	−1	602	71,974
Subtotal—Military Functions	96,219,044	6,737,911	6,830,765	10,525,024	82,649,293	13,569,751
Military Assistance	405,656	42,583	39,223	152,270	400,656	5,001
TOTAL—DEPARTMENT OF DEFENSE	96,624,700	6,780,494	6,869,988	10,677,294	83,049,949	13,574,752

Department of the Army

Department of the Army	Available for obligation	Obligations April 1968	Obligations May 1968	Obligations June 1968	Obligations Cum thru June 30, 1968	Unobligated balance June 30, 1968
Military Personnel						
Active forces	7,928,001	689,419	681,511	735,521	7,922,908	5,093
Reserve forces	608,076	35,743	51,521	85,652	571,717	36,359
Total—Military Personnel	8,536,077	725,162	733,032	821,173	8,494,625	41,452
Operation and Maintenance	9,270,460	714,590	794,697	1,458,566	9,247,034	23,426
Procurement						
Aircraft	1,532,161	51,998	295,172	325,285	1,194,728	337,433
Missiles	711,080	45,730	25,512	61,010	629,902	81,178
Tracked combat vehicles	534,966	53,268	25,037	115,566	463,968	70,998
Ordnance, vehicles and related equipment	5,350,496	455,357	230,934	655,067	4,405,522	944,974
Electronics and communications	914,510	25,251	63,989	180,459	624,035	290,475
Other procurement	1,162,606	99,173	153,743	144,056	838,050	324,556
Undistributed	284,594	—	—	—	—	284,594
Total—Procurement	10,490,413	730,777	794,387	1,481,443	8,156,205	2,234,208
Research, Development, Test, & Evaluation						
Military sciences	186,365	8,469	8,832	17,830	158,332	28,033
Aircraft	161,819	6,542	8,202	15,941	124,617	37,202
Missiles	700,598	17,030	10,357	53,593	683,884	16,714
Astronautics	12,181	−82	1,087	1,719	10,685	1,496
Ordnance, vehicles and related equipment	209,051	4,849	8,248	24,076	171,625	37,426
Other equipment	452,172	25,382	30,310	48,480	327,849	124,323
Program-wide management and support	87,534	3,416	4,032	5,495	80,393	7,141
Undistributed	58,994	—	—	—	—	58,994
Total—Research, Development, Test & Eval.	1,868,714	65,606	71,068	167,134	1,557,385	311,329
Military Construction	1,438,099	50,536	117,406	153,792	725,239	712,860
TOTAL—DEPARTMENT OF THE ARMY	31,603,764	2,286,672	2,510,590	4,082,108	28,180,488	3,423,275

Department of the Navy

Department of the Navy	Available for obligation	Obligations April 1968	Obligations May 1968	Obligations June 1968	Obligations Cum thru June 30, 1968	Unobligated balance June 30, 1968
Military Personnel						
Active forces	5,646,272	475,524	487,004	514,466	5,644,140	2,132
Reserve forces	160,462	12,679	12,127	18,736	157,094	3,368
Total—Military Personnel	5,806,734	488,203	499,132	533,201	5,[illegible]1,234	5,500
Operation and Maintenance	6,104,588	603,852	431,023	732,446	6,098,669	5,919
Procurement						
Aircraft	4,147,035	469,492	359,824	542,557	2,982,895	1,164,140
Missiles	744,524	63,726	20,362	39,072	531,677	212,847
Ships	4,763,125	90,859	258,387	378,578	1,869,376	2,893,749
Tracked combat vehicles	26,241	499	2,265	689	7,725	18,516
Ordnance, vehicles and related equipment	2,161,185	72,156	72,640	140,254	1,727,421	433,764
Electronics and communications	785,215	58,204	26,592	132,356	522,999	262,216
Other procurement	1,550,386	120,100	62,400	151,629	1,115,083	435,303
Undistributed	−4,100	—	—	—	—	−4,100
Total—Procurement	14,173,611	875,035	802,468	1,385,137	8,757,176	5,416,435
Research, Development, Test, and Evaluation						
Military sciences	188,889	9,942	20,470	12,923	183,099	5,790
Aircraft	356,090	24,386	6,068	66,297	312,248	43,842
Missiles	815,656	24,303	27,119	41,805	785,146	30,510
Astronautics	24,194	426	1,097	605	19,739	4,455
Ships	373,327	20,490	26,947	34,690	324,179	49,148
Ordnance, vehicles and related equipment	190,094	11,264	7,885	22,201	170,148	19,946
Other equipment	146,170	9,552	4,994	18,281	125,453	20,717
Program-wide management and support	384,239	29,443	29,516	63,181	328,637	55,602
Undistributed	—	—	—	—	—	—
Total Research, Development, Test & Eval.	2,478,659	129,806	124,096	259,983	2,248,649	230,010
Military Construction	1,106,127	43,474	73,839	156,838	598,110	508,017
TOTAL—DEPARTMENT OF THE NAVY	29,669,720	2,140,369	1,930,559	3,067,604	23,503,837	6,165,883

Department of the Air Force	Available for obligation	Obligations April 1968	May 1968	June 1968	Cum thru June 30, 1968	Unobligated balance June 30, 1968
Military Personnel						
Active forces	5,717,507	457,481	471,599	456,653	5,710,672	6,835
Reserve forces	156,133	11,410	10,660	17,533	147,824	8,309
Total—Military Personnel	5,873,640	468,892	482,257	474,187	5,858,496	15,144
Operation and Maintenance	6,604,394	526,735	493,897	669,676	6,591,880	12,514
Procurement						
Aircraft	7,850,572	348,352	451,799	899,428	5,968,350	1,882,222
Missiles	1,678,090	131,035	64,653	152,070	1,327,530	350,560
Ships	—	—	—	—	—	—
Ordnance, vehicles and related equipment	2,023,172	40,577	113,815	169,140	1,635,516	387,656
Electronics and communications	676,226	54,744	30,863	65,278	457,318	218,908
Other Procurement	596,101	55,150	43,538	74,049	523,132	72,972
Undistributed	—	—	—	—	—	—
Total—Procurement	12,824,161	629,858	704,668	1,359,965	9,911,846	2,912,315
Research, Development, Test, & Evaluation						
Military sciences	176,472	8,411	10,619	15,648	156,083	20,389
Aircraft	903,561	55,378	49,461	44,985	856,353	47,208
Missiles	1,010,368	52,473	58,226	68,836	996,895	13,473
Astronautics	1,202,171	133,443	67,288	95,926	1,135,778	66,393
Other equipment	336,728	15,072	14,506	26,342	290,312	46,416
Program-wide management and support	267,330	23,497	19,438	26,245	264,136	3,194
Undistributed	25,937	—	—	—	—	25,937
Total—Research, Development, Test & Eval.	3,922,567	288,273	219,539	277,982	3,699,557	223,010
Military Construction	783,512	29,629	99,393	122,046	446,585	336,927
TOTAL—DEPARTMENT OF THE AIR FORCE	30,008,273	1,943,387	1,999,754	2,903,857	26,508,365	3,499,908

Defense Agencies/Office of the Secretary of Defense

Military Personnel						
Retired Pay	2,095,000	184,568	185,675	187,508	2,093,478	1,522
Operation and Maintenance	1,055,685	87,033	87,047	98,835	1,052,674	3,011
Procurement						
Ordnance, vehicles and related equipment	4,820	238	1,261	−44	3,028	1,792
Electronics and communications	13,437	1,312	1,747	1,497	10,346	3,091
Other procurement	68,693	1,880	3,047	8,634	41,991	26,702
Undistributed	6,154	—	—	—	—	6,154
Total—Procurement	93,104	3,430	6,055	10,087	55,365	37,739
Research, Development, Test, and Evaluation						
Military sciences	589,398	28,460	48,761	81,085	494,798	94,600
Emergency Fund	—	—	—	—	—	—
Undistributed	—	—	—	—	—	—
Total—Research, Development, Test & Eval.	589,398	28,460	48,761	81,085	494,798	94,600
Military Construction	49,218	2,650	2,021	3,944	14,424	34,794
Family Housing	873,745	56,153	52,681	70,277	645,127	228,618
Other—Special Foreign Currency Program	72,576	159	276	−1	602	71,974
TOTAL—DEFENSE AGENCIES/OSD	4,828,726	362,452	382,516	451,737	4,356,469	472,258

Office of Civil Defense

Civil Defense	108,561	5,032	7,345	19,718	100,134	8,427

Military Assistance

Military Personnel	52	18	−3	54	52	—
Operation and Maintenance	203,130	36,226	11,792	14,702	198,129	5,001
Procurement						
Aircraft	77,215	1,241	10,939	55,595	77,215	—
Missiles	−2,461	1,114	−431	573	−2,461	—
Ships	15,963	−8	1,562	6,492	15,963	—
Ordnance, vehicles and related equipment	71,611	464	5,729	44,590	71,611	—
Electronics and communications	26,397	433	7,124	19,239	26,397	—
Other procurement	28,462	2,829	2,189	10,821	28,462	—
Total—Procurement	217,187	6,073	27,112	137,310	217,187	—
Research, Development, Test, and Evaluation	−1,342	−15,037	14,996	—	−1,342	—
Military Construction	−13,375	15,279	−14,664	192	−13,375	—
Undistributed	6	24	−9	12	6	—
TOTAL—MILITARY ASSISTANCE	405,656	42,583	39,223	152,270	400,656	5,001

NOTE: All expenditure amounts are on a net Treasury basis (gross payments less reimbursement collections), whereas obligations and unpaid obligations are on a gross basis (inclusive of reimbursable activity performed by components of DOD for each other). Therefore, unpaid obligations as of the end of the reporting month cannot be computed from other figures in this report.

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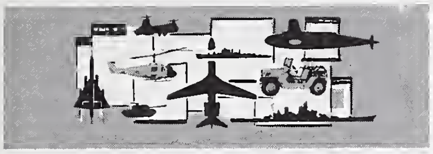

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of October 1968.

DEFENSE SUPPLY AGENCY

1—**Nantex-Riviera Corp.**, New York, N.Y. $2,311,868. 5,415,840 pairs of men's cotton drawers. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–69–C–0537.

2—**U.S. Steel**, Pittsburgh, Pa. $1,036,512. 11,476,300 lbs. of zinc-coated corrugated steel sheets. Defense Industrial Supply Center, Philadelphia, Pa. DSA 500–69–C–2556.

—**Carborundum Co.**, Niagara Falls, N.Y. $15,869,310. 46,000 sets of body armor for the Army. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–69–C–0548.

3—**U.S. Steel**, Pittsburgh, Pa. $1,800,472. 20,483,190 lbs. of corrugated, zinc-coated steel. Defense Industrial Supply Center, Philadelphia, Pa. DSA 500–69–C–3337.

7—**Southern Packaging & Storage Co.**, Greeneville, Tenn. $2,544,615. 3,465,796 cases of individual combat meals. Defense Personnel Support Center, Philadelphia, Pa. DSA 130–69–C–SO17.

9—**Glenberry Mfg., Inc.**, Commerce, Okla. $1,374,310. 500,000 pairs of men's trousers Defense Personnel Support Center, Philadelphia, Pa. DSA 100–69–C–0540.

—**Winfield Mfg., Inc.**, Winfield, Ala. $1,976,000. 800,000 pairs of men's trousers. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–69–C–0539.

14—**Suntide Refining Co.**, Tulsa, Okla. $2,789,472. 29,400,000 gallons of grade JP–4 jet fuel. Defense Fuel Supply Center, Alexandria, Va. DSA 600–68–D–2245 P005.

—**Sinclair Oil Corp.**, New York, N.Y. $2,378,880. 25,200,000 gallons of JP–4 jet fuel. Defense Fuel Supply Center, Alexandria, Va. DSA 600–68–D–2237 P005.

—**Humble Oil & Refining Co., Houston, Tex.** $1,752,513. 17,850,000 gallons of JP–4 jet fuel. Defense Fuel Supply Center, Alexandria, Va. DSA 600–68–D–2214 P006.

—**Southwestern Oil & Refining Co.**, Corpus Christi, Tex, $1,651,440. 16,800,000 gallons of JP–4 jet fuel. Defense Fuel Supply Center. Alexandria, Va. DSA 600–68–D–2240 P006.

—**Riegel Textile Corp.**, New York, N.Y. $2,679,320. 4,546,667 linear yards of cotton sateen cloth (45-inch) and 700,000 linear yards of 42-inch cotton sateen cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–69–C–0569.

—**Graniteville Co.**, New York, N.Y. $2,297,710. 4,300,000 linear yards of 45-inch cotton sateen cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–69–C–0570.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

23—**Pittston Clinchfield Sales Corp.**, New York, N.Y. $2,700,000. 450,000 tons of bituminous coal. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–C–0609.

24—**National Steel Corp.**, Weirton, W. Va. $2,137,879. 24,873,520 lbs. of corrugated steel sheets. Defense Industrial Supply Center, Philadelphia, Pa. DSA 50C–69–C–3456

—**Gulf Oil Corp.**, Houston, Tex. $10,012,668. Fuel oil and gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0051.

—**Hess Oil & Chemical Corp.**, Perth Amboy, N.J. $3,487,530. Fuel oil and gasoline. Defense Fuel Supply Center Alfxandria,, Va. DSA 600–69–D–0056.

—**Max Waller Co., Inc.**, Baltimore, Md. $2,355,545. Fuel oil and gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0111.

—**American Oil Co.**, Chicago, Ill. $2,151,237. Fuel oil and gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0013.

—**Charles J. McNulty, Inc.**, Riverside, N.J. $1,000,840. Fuel oil and gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0064.

28—**Dana Corp.**, Reading, Pa. $1,467,163. 320,040 steel helmets. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–69–C–0682.

—**Kings Point Industries**, Fayetteville, N.C. $1,054,500. 75,000 armor protective vests, with collars. Defense Personnel Support Center , Philadelphia, Pa. DSA 100–68–C–2375–P002.

31—**Sun Oil Co.,**, Philadelphia, Pa. $8,452,130, 1,490,000 barrels of motor gasoline, Type I and 350,000 barrels of Grade DF–1 diesel fuel. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0550.

—**Union Oil Co.**, Los Angeles, Calif. $8,160,820. 3,280,000 barrels of Navy special burner fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0558.

—**Marathon Oil Co.**, Findlay, Ohio. $4,270,070. 1,060,000 barrels of Grade DF–1 diesel fuel oil. Defense Fuel Supply Center, Alexandria, Va DSA 600–69–D–0552..

—**American Oil Co.**, Chicago, Ill. $4,178,790. 930,000 barrels of marine diesel. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0553.

—**Powerine Oil Co.**, Sante Fe Springs, Calif. $3,759,000. 1,500,000 barrels of Navy special burner fuel oil. Defense Fuel Supply Center. Alexandria, Va. DSA 600–69–D–0557.

—**Mobil Oil Corp.**, New York, N.Y. $3,533,232. 480,000 barrels of marine diesel fuel oil; 8,000 barrels of kerosene and 840,000 barrels of number six fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0555.

—**Golden Eagle Refining Co.**, Los Angeles, Calif. $2,317,410. 900,000 barrels of Navy special burner fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0560.

—**Atlantic Richfield Co.**, Los Angeles, Calif. 800,000 barrels of Navy special burner fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0556.

—**Hess Oil & Chemical Corp.**, Woodbridge, N.J. $1,892,000. 400,000 barrels of marine diesel and 200,000 barrels of number six fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0554.

—**Edgington Oil Refineries**, Long Beach, Calif. $1,699,434. 660,000 barrels of Navy special fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600–69–D–0559.

DEPARTMENT OF THE ARMY

1—**Federal Electric Co.**, Paramus, N.J. $1,977,000. Engineering, installation and testing of an integrated LOS microwave telecommunications system in the Federal Republic of Germany. Electronics Command, Fort Monmouth, N.J. DA AB07–69–C–0072.

—**Dynalectron Corp.**, Washington, D.C. $1,274,440 (modification to a previous contract). Three months operational extension for data collection and relatel support services. White Sands Missile Range, N.M. DA 29–040–AMC–01505 (R).

—**Cornell Aeronautical Laboratories**, Buffalo, N.Y., $1,019,077. Services and materiel for an 18-month period to conduct investigation systems integration study and testing. Falls Church, Va. Electronics Command, Fort Monmouth, N.J. DA AB07–69–C–0069.

—**Philco-Ford Corp.**, Newport Beach, Calif. $1,499,979. FY 1969 research and development on the Chaparral missile program. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0542.

—**AVCO Corp.**, Richmond, Va. $1,145,621. (modification to a previous contract). Purchase of industrial plant equipment for the manufacture of components for 155mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA–33–008–AMC–00150 (A).

—**Raytheon Co.**, Andover, Mass. $1,519,657. Engineering and product assurance services for the Hawk missile system. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0384.

—**Martin-Marietta Corp.**, Orlando, Fla. $1,785,584 (modification to a previous contract). Industrial engineering services in support of the Pershing weapon system. Army Missile Command, Huntsville, Ala. DA AH01–68–C–0257.

—**MIF Industries, Inc.**, Branford, Conn. $1,956,000. Type G lifting plug for heavy artillery projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–68–C–0084.

—**Dunbar & Sullivan Dredging Co.**, Cleveland, Ohio. $2,069,250. Construction of a stone dike. Cuyahoga County, Ohio. Engineer Dist., Buffalo, N.Y. DA CW49–69–C–0013.

2—**Lear Siegler, Inc.**, Anaheim, Calif. $8,287,625. Metal parts for fuzes for 105mm cartridges. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0169.

—**AVCO Corp.**, Stratford, Conn. $2,343,371. Turbine nozzles for T–53 engines used on UH–1 helicopters. Aviation Materiel Command, St. Louis, Mo. AF–41 608–67–A–3234.

—**Hughes Aircraft**, Culver City, Calif. $2,671,500. AN/VVS–1 laser range finders. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0153.

—**Babcock & Wilcox Co.**, Detroit, Mich. $1,418,750. Rapid boring lathes. Army Procurement Agency, Chicago, Ill. DA AG11–69–C–0201.

—**White Motor Co.**, Lansing, Mich. $8,082,283. 2½-ton trucks. General Purpose Vehicle Project Manager, Warren, Mich. DA AE06–69–C–0003.

3—**FMC Corp.**, San Jose, Calif. $11,287,730. M113A1 personnel carriers, XM730 Chaparal vehicles, and XM741 Vulcan vehicles. Tank Automotive Command, Warren, Mich. DA AE07–69–C–0472.

—**Walter Kidde Co.**, Belleville, N.J. $4,707,-415. Metal parts for fuzes for 105mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0163.

—**Keystone Mfg. Corp.**, Boston, Mass. $4,-468,599. Metal parts for fuzes for 105mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0154.

—**Clevite Corp.**, Freeport, Ill. $1,427,229 (contract modification). Dry batteries. Electronics Command, Philadelphia, Pa. DA AB05–68–C–2472.

—**Union Carbide**, New York, N.Y. $2,796,-692. Dry batteries. Electronics Command, Philadelphia, Pa. DA AB05–69–C–3095.

—**Atlantic Research Corp.**, West Hanover, Mass. $1,781,200. Loading and assembly of 60mm illuminating projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0165.

4—**White Motor Corp.**, Lansing, Mich. $2,-536,068 (definitization of a previously awarded contract). 2½-ton trucks. General Purpose Vehicle Project Manager, Warren, Mich. DA AE08–67–C–5819.

—**Honeywell, Inc.**, Hopkins, Minn. $1,055,-340, Fuzes for 40mm cartrdiges. New Brighton, Minn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–68–C–0487.

—**Hensel Phelps Construction Co.**, Greeley, Colo. $1,099,000. Construction of an Air National Guard facility. Forbes AFB, Kan. Engineer Dist., Kansas City. Mo. DA CA41–69–C0022.

—**Colt's, Inc.**, Hartford, Conn. $23,402,525. M16A1 rifles. Army Weapons Command, Rock Island, Ill. DA AF03–69–C–0021.

7—**Consolidated Diesel Electric Co.**, Old Greenwich, Conn. $12,211,480 (contract modification). Ten-ton tractor trucks. Scotia, N.Y. Tank Automotive Command, Warren, Mich. DA AE07–67–C–5761.

—**UMC Industries**, Goodyear, Ariz. $3,247,-681. M18 grenades. Edgewood Arsenal, Md. DA AA15–69–C–0158.

—**AVCO Corp.**, Richmond, Ind. $2,016,900. Metal parts for 2.75-inch rocket components. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0158.

—**Bulova Watch Co.**, Jackson Heights, N.Y. $1,410,232. Metal parts for 2.75-inch rockets. Woodside, N.Y. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0195.

8—**United Ammunition Container, Inc.**, $2,-495,087. Fiber ammunition containers for 81mm projectiles. Milan, Tenn. Army Procurement Agency, Chicago, Ill. DA AG11–69–C–0232.

—**AVCO Corp.**, Stratford, Conn. $2,464,-568. Engine components for UH–1 Iroquois helicopters. Aviation Materiel Command, St. Louis, Mo. AF–41–608–67–3234.

9—**Darragh & Lyda, Inc.**, San Antonio, Tex. $2,966,731. Construction of a composite medical facility at Bergstrom AFB, Tex. Engineer Dist., Fort Worth, Tex. DA CA63–69–C–0030.

—**Shappert Engineering Co.**, Bellvidere, Ill. $1,589,725. Construction work on a channel from Linwood, Iowa, to about the middle of Credit Island. Scott Counnty, Iowa, and Rock Island County, Ill. Engineer Dist., Rock Island, Ill. DA CW23–69–D–0005.

10—**Grumman Aircraft Engineering Corp.**, $3,075,140. Remodernization of OV–1A Mohawk helicopters. Aviation Materiel Command, St. Louis, Mo. DA AJ01–68–C–1561.

—**Lockheed Aircraft**, Plainfield, N.J. $2,-600,000. Radar set repair parts for the Vulcan Air Defense System. Army Procurement Agency, New York, N.Y. DA AG25–69–C–0356.

—**Boeing Co.**, Morton, Pa. $2,145,570. Rotary wing heads for CH–47 Chinook helicopters. Aviation Materiel Command, St. Louis, Mo. DA AJ01–68–A–0005.

—**Pott Industries**, St. Louis, Mo. $1,933,-750. Construction and delivery of a snag boat. Engineer Dist., Philadelphia, Pa. DA CW61–69–C–0042.

—**Tepfer & Sons**, Deer Park, N.Y. $1,815,-643. Adapters and fin assemblies for bombs. Edgewood Arsenal, Md. DA AA15–69–C–0160.

—**Hayes Albion Corp.**, Albion, Mich. $1,-597, 320. Metal parts for 2.75-inch rocket warheads. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0128.

—**Harvey Aluminum**, Torrance, Calif. $1,-588,317. 40mm cartridge cases. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0178.

—**Amron Corp.**, Waukesha, Wis. $1,562,962. 40mm cartridges cases. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0177.

—**Hayes International Corp.**, Birmingham, Ala. $1,290,900. Metal parts for 2.75-inch rocket warheads. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0135.

—**Aerojet General Corp.**, Downey, Calif. $1,214,986. Metal parts for 2.75-inch rocket warheads. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0134.

11—**Johnson Construction Co. and Massman Construction Co.**, Minneapolis, Minn. $27, 842,862. Construction of lock and appurtenant works at the Willow Island Lock and Dam Project on the Ohio River. Washington County, Ohio. Engineer Dist., Huntington, W. Va. DA CW69–69–C–0030.

—**Beech Aircraft Corp.**, Wichita, Kan. $2,-137,215. Bomb dispensers. Salina, Kan. Army Procurement Agency, Chicago, Ill. DA AA09–69–C–0008.

—**Cessna Aircraft Corp.**, Wichita, Kan. $1,-977,985. Bomb dispensers. Army Procurement Agency, Chicago, Ill. DA AA09–69–C–0007.

—**Federal Laboratories**, Saltsburg, Pa. $1,-140,221. Hand grenades. Edgewood Arsenal, Md. DA AA15–69–C–0177.

—**General Motors**, Detroit, Mich. $33,441,-000. Metal parts for 105mm projectiles. St. Louis, Mo. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0108.

—**Brunswick Corp.**, Lincoln, Neb. $2,988,-000. Grommets for 155mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0185.

—**Brunswick Corp.**, Muskegon, Mich. $2,046,-660. Bomb dispensers. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0203.

—**Automatic Sprinkler Corp.**, Dallas, Tex. $1,990,674. Bomb dispensers. Carrolton, Tex. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0204.

—**Kennedy Van Saun Corp.**, Danville, Pa. $1,805,144. Metal parts for 90mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0205.

—**G-Z Products**, Rancho Cordova, Calif. $1,659,530. Grommets for 175mm projectiles and eight-inch projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0186.

14—**John Wood Co.**, St. Paul, Minn. $1,454,-411. Fin assemblies for 500-lb. bombs. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0208.

—**Talley Industries**, Mesa, Ariz. $3,909,427. M18 colored-smoke hand grenades. Edgewood Arsenal, Md. DA AA15–69–C–0179.

—**Lockheed Aircraft Service Co.**, Lake Charles, La. $1,811,000. Inspection and repair of UH–1D helicopters. Aviation Materiel Command, St. Louis, Mo. DA AJ01–69–D–0029.

15—**David Band, Inc.**, New Orleans, La. $2,043,956. 2,237,500 fiber ammunition containers for 105mm artillery shells. Army Procurement Agency, Chicago, Ill. DA AG11–69–C–0247.

—**Paper Tubes, Inc.**, Buffalo, N.Y. $2,062,-751. 2,237,500 fiber ammunition containers for 105mm artillery shells. Army Procurement Agency, Chicago, Ill. DA AG11–79–C–0248.

—**Consolidated Box Corp.**, Tampa, Fla. $3,-022,974. 3,356,250 fiber ammunition containers for 105mm artillery shells. Army Procurement Agency, Chicago, Ill. DA AG11–69–C–0249.

—**Stone Container Corp.**, Chicago, Ill. $1,-030,481. 1,118,750 fiber ammunition containers for 105mm artillery shells. Army Procurement Agency, Chicago, Ill. DA AG11–69–C–0250.

—**Norris Industries**, Los Angeles, Calif. $1,791,360. 90mm cartridge cases. Army Procurement Agency, Pasadena, Calif. DA AG07–69–C–0229.

16—**Chamberlain Mfg. Corp.**, Elmhurst, Ill. $5,894,899. Cartridge cases for 105mm projectiles. Burlington, N.J. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0182.

17—**Tepfer & Sons, Inc.**, Deer Park, N.Y. $2,241,674. Fin assemblies for 750-lb. bombs. Edgewood Arsenal, Md. DA AA15–69–C–0172.

—**Kollsman Instrument Corp.**, Elmhurst, N.Y. $2,319,000. Metal parts for detonating fuzes. Melrose Park, Ill. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0222.

—**American Fabricated Products Co.**, Indianapolis, Ind. $1,189,000. Cartridge containers for obturating assemblies for 4.2-inch mortars. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0201.

—**Bauer Ordnance Corp.**, Warren, Mich. $1,991,400. Bayonet knives for M16 rifles. Army Weapons Command, Rock Island, Ill. DA AF01–69–C–0224.

18—**Bell Aero-Systems**, Tucson, Ariz. $1,297,-940. (contract modification). Study of electro-magnetic data collection. Electronics Command, Fort Monmouth, N.J. DA AB07–68–C–0029.

—**Brunswick Corp.**, Sugar Grove, Va. $2,-403,302. Green smoke hand grenades. Edgewood Arsenal, Md. DA AA15–69–C–0159.

—**Fisher Chemical Corp.**, Englewood Cliffs, N.J. $3,876,660. 810,000 lbs. of organic chemical. Great Meadows, N.J. Edgewood Arsenal, Md. DA AA15–69–C–0181.

—**General Motors**, Cleveland, Ohio. $4,503,-042 (contract modification). Engineering services for one year on the armored reconnaissance/airborne assault vehicle, M551. Army Weapons Command, Rock Island, Ill. DA 33–019–AMC–00248 (W).

—**Chamberlain Mfg. Co.**, Elmhurst, Ill. $3,-044,122. Metal parts for 105mm smoke projectiles. Waterloo, Iowa. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–68–C–0489.

21—**URS Corp.**, San Mateo, Calif. $1,475,000 (contract modification). Advancement of design, development, programming and testing of Seventh Army (Combat Support) control center prototype software. Karlsruhe, West Germany and Falls Church, Va. DA 02–086–AMC–00539 (Y).

—**Day & Zimmerman, Inc.**, Philadelphia, Pa. $99,219,021. Load, assemble and pack miscellaneous selected ammunition items and components. Texarkana, Tex. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11–173–AMC–00114 (A).

—**Remington Arms, Inc.**, Bridgeport, Conn. $82,887,419. Manufacture of small arms ammunition and for support services. Independence, Mo. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 49–010–AMC–00003 (A).

—**Thiokol Chemical Corp.**, Bristol, Pa. $74,-044,046. Load, assemble and pack mortars, igniters, flares and related ammunition components. Marshall, Tex. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11–173–AMC–0 200 .A).

—**Honeywell, Inc.**, Hopkins, Minn. $2,265,-000. Metal parts for artillery shell fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0191.

—**K.D.K. Corp.**, Niles, Ill. $2,384,278. Assembly of ammunition fiber containers. Albuquerque, N.M. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0229.

23—**K.D.I. Precision Products, Inc.**, Cincinnati, Ohio. $1,518,075. Metal parts for 2.75-inch rocket fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0196.

—**Muncie Gear Works**, Muncie, Ind. $10,-803,708. 2.75-inch rocket fin and nozzle assemblies. Muncie and Kokomo, Ind. Picatinny Arsenal, Dover, N.J. DA AA21–69–C–0143.

—**HITCO**, Denver, Colo. $10,584,000. 2.75-inch rocket fin and nozzle assemblies. Picatinny Arsenal, Dover, N.J. DA AA21–69–C–0144.

—**Hoffman Electronics Corp.**, El Monte, Calif. $9,055,00. 2.75-inch rocket fin and nozzle assemblies. El Monte, Calif. and Kokomo, Ind. Picatinny Arsenal, Dover, N.J. DA AA21–69–C–0146.

—**Jackson Products Co.**, Tampa, Fla. $7,-176,000. 2.75-inch rocket fin and nozzle assemblies. Tampa, Fla. and Kokomo, Ind. Picatinny Arsenal, Dover, N.J. DA AA21–69–C–0204.

24—**Hughes Aircraft**, Culver City, Calif. $8,-109,159 (contract modification). FY 1969 TOW weapon system engineering services. Army Missile Command, Huntsville, Ala. DA AH01–68–C–2155.

—Zeller Corp., Defiance, Ohio. $2,516,603. Metal parts for 20mm projectiles. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0184.

—Harvey Aluminum, Inc., Torrance, Calif. $2,490,024. Metal parts for 20mm projectiles. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0183.

—Whittaker Corp., Saugus, Calif. $2,376,-000. Load, assemble and pack 20mm ammunition fuzes. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0177.

—M. Steinthal & Co., New York, N.Y. $1,-918,142. Cargo parachutes. Roxboro, N.C. Aviation Materiel Command, St. Louis, Mo. DA AJ01–69–C–0176

—Switlix Parachute Co., Trenton, N.J. $1,-918,142. Cargo parachutes. Aviation Materiel Command, St. Louis, Mo. DA AJ01–69–C–0174.

—Miles Mfg. Corp., Asheville, N.C. $1,918,-142. Cargo parachutes. Marshall and Asheville, N.C. Aviation Materiel Command, St. Louis, Mo. DA AJ01–69–C–0175.

25—Colt's Inc., Hartford, Conn. $8,189,327 (contract modification). 20-round magazine assemblies for the M–16 weapons family; $3,813,512. Repair parts in support of the M–16 weapons family. Army Weapons Command, Rock Island, Ill. DA AF03–69–C–0007. DA AF03–69–C–0030.

—Kilgore Corp., Toone, Tenn. $1,935,360. 105mm shells. Edgewood Arsenal, Md. DA AA15–69–C–0209.

—Chrysler Corp., Centerline, Mich. $1,312,-093. Advanced production engineering for the XM746 truck and XM747 semi-trailer. Tank Automotive Command, Warren, Mich. DA AE07–68–C–2974.

—Brennand Construction Co., Albuquerque, N.M. $1,170,700. Construction of a hospital addition and alterations at Sandia Base, N.M. Engineer Dist., Albuquerque, N.M. DA CA47–69–C–0030.

—Z.D. Products, Los Angeles, Calif. $5,232,-379. Metal parts for artillery fuze delay plungers. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0197.

—Keystone Mfg. Co., Boston, Mass. $3,815,-606. Metal parts for artillery fuze delay plungers. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0206.

—Chamberlain Mfg. Corp., Waterloo, Iowa. $3,667,144. Metal parts for 2.75-inch rocket components. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0234.

—National Union Electric Corp., Bloomington, Ill. $1,116,000. bomb fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0235.

28—Norris Industries, Los Angeles, Calif. $11,020,680. Motor tubes for 2.75-inch rocket motors. Pico Rivera, Calif. Picatinny Arsenal, Dover, N.J. DA AA21–69–C–0243.

—Aluminum Corp., of America, Pittsburgh, Pa. $5,824,350. Motor tubes for 2.75-inch rocket motors. New Kensington, Pa. Picatinny Arsenal, Dover, N.J. DA AA21–69–C–0236.

29—Land-Air, Inc., Grand Prairie, Tex. $2,-072,000. Type G lifting plugs for 155mm and 175mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0239.

—Thiokol Chemical Corp., Woodbine, Ga. $1,868,035. CS–2 riot control agent. $8,-437,673. CS–1 riot control agent. Edgewood Arsenal, Md. DA AA15–69–C–0210. DA AA15–69–C–0182.

—Batesville Mfg. Co., Camden, Ark $3,129,-663. 50-lb. cluster canisters. Edgewood Arsenal, Md. DA AA15–69–C–0213.

—Hercules Engine, Inc., Canton, Ohio. $2,-329,179. Ten and 20-horsepower standard engines, Army Mobility Equipment Command, St. Louis, Mo. DA 23–195–AMC–00284 (T).

—K D I Precision Products, Inc., Cincinnati, Ohio. $1,537,910. Safety and arming devices for M429 fuzes. Army Procurement Agency, Cincinnati, Ohio DA AA09–69–C–0220.

30—Hercules Engines, Inc., Canton, Ohio. $3,274,788 (contract modification). LD-465–1 engine assemblies for 2½-ton trucks. Tank Automotive Command, Warren, Mich. DA AE06–68–C–0006.

—Martin Marietta Corp., Orlando, Fla. $16,680,304. 1,078,296 man hours of industrial engineering services for the Pershing weapons system. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0616.

—Ametek, Inc., Sheboygan, Wis. $1,470,800. Stabilizer rods for 2.75-inch rockets. Picatinny Arsenal, Dover, N.J. DA AA21–69–C–0214.

—Sargent Bros., Division of Parker-Hannifin Corp., Tulsa, Okla. $1,097,434. Damper assemblies for UH–1 helicopters. Aviation Materiel Command, St. Louis, Mo. DA 23–240–AMC–03669.

—General Dynamics, Pomona, Calif. $2,-071,233. FY 1969 Redeye engineering services. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0683.

—AVCO Corp., Stratford, Conn. $1,009,515. T53–L–701 engines for Mohawk aircraft. Aviation Materiel Command, St. Louis, Mo. DA AJ01–68–C–1874.

—Supreme Products Corp., Chicago, Ill. $1,877,720. Metal parts for 20mm fuses. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0164.

—Galion Amco, Inc., Galion, Ohio. $2,159,-700. Metal parts for 20mm fuzes. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0165.

—Z.D. Products, El Segundo, Calif. $1,222,-262. 20mm projectiles. Costa Mesa, Calif. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0194.

—Harvey Aluminum, Inc., Torrance, Calif. $1,116,788. 20mm projectiles. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0195.

—Lockheed Electronics Co., Plainfield, N.J. $1,295,000. Radar sets and installation kits used in 20mm AAA gun fire control systems. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0196.

—Federal Cartridge Corp., Minneapolis, Minn. $95,145,563 (contract modification). Production of small arms ammunition and support services at the Twin Cities Army Ammunition Plant, New Brighton, Minn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 36–038–AMC–01099 (A).

—Firestone Tire & Rubber Co., Akron, Ohio. $11,617,036 (contract modification). Loading, assembling and packing of ammunition items and support services at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11–173–AMC–00065 (A).

—Harvey Aluminum Sales, Inc., Torrance, Calif. $73,725,632 (contract modification). Loading, assembling and packing of medium caliber ammunition and components; and for maintenance and support services at the Army Ammunition Plant, Milan, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11–173–AMC–00520 (A).

—Hercules, Inc., Wilmington, Del. $47,767,-126 (contract modification). Production of propellants and explosives and for support services at the Army Ammunition Plant, Radford, Va.; $9,590,286 (contract modification). Modification for production of rocket propellant and support services at the Sunflower Army Ammunition Plant, Lawrence, Kan. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11–173–AMC–00037 (A). DA 11–173–AMC–00042 (A).

—Holston Defense Corp., Kingsport, Tenn. $25,126,269 (contract modification). Production of explosives and support services at the Holston Army Ammunition Plant, Kingsport, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11–173–AMC–00035 (A).

—Mason & Hanger—Silas Mason Co., Inc., New York, N.Y. $51,993,761 (contract modification). Loading, assembling and packing of medium and large caliber ammunition items and components; and for support services at the Army Ammunition Plant, Burlington, Iowa. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–68–C–0468.

—Olin Mathieson Chemical Corp., New York N.Y. $48,885,552 (contract modification). Production of propellants, bags and related ammunition components; $12,956,-416 (contract modification). Production of various propellants and for support services at the Badger Army Ammunition Plant, Baraboo, Wis. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11–173–AMC–00097 (A). DA AA09–69–C–0014.

—Sperry Rand Corp., New York, N.Y. $38,-477,031 (contract modification), Production of major caliber ammunition items and components. Shreveport, La. Ammunition Procurement & Supply Agency, Joliet, Ill.

—Uniroyal, Inc., New York, N.Y. $126,-842,519 (contract modification), Manufacture of various explosives, packing, loading, and assembling of 105mm and 8-inch projectiles, and for support services at the Army Ammunition Plant, Joliet, Ill. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11–173–AMC–00062 (A).

—Chamberlain Mfg. Corp., New Bedford, Mass. $12,252,000. Metal parts for 155mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0238.

—Model Screw Products, Inc., Hazelwood, Mo. $1,168,500. Cartridge containers for obturating assemblies for 4.2-inch mortars. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0240.

—Bulova Watch Co., Flushing, N.Y. $5,518,-276. MT M565 fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0242.

31—Green Construction Co., Des Moines, Iowa. $19,499,570. Construction work at the Raystown Reservoir Project. Huntington County, Pa. Engineer Dist., Baltimore, Md. DA CW31–69–C–0013.

—Martin Marietta Corp., Orlando, Fla. $3,-754,117. Modification kits for Pershing Weapons System ground equipment. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0663.

—General Motors, Indianapolis, Ind. $1,392,-390. Transmission assemblies. Tank Automotive Command, Warren, Mich. DA AE07–69–C–0535.

—Ford Motors, Dearborn, Mich. $1,893,550 (contract modification). Engineering support to produce five-ton trucks. Wixsom, Mich. Tank Automotive Command, Warren, Mich. DA AE07–68–C–0445.

—Philco-Ford Corp., Newport Beach, Calif. $5,425,000. Shillelagh engineering services. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0684.

—Sylvania Electric Products, Inc., Mountain View, Calif. $1,989,000. Research and development in electronic warfare. Electronics Command, Fort Monmouth, N.J. DA AB07–68–A–0503.

—Hughes Aircraft, Fullerton, Calif. $4,-594,453 (contract modification). Radio sets. Army Procurement Agency, Pasadena, Calif. DA AB05–68–C–0008.

—General Electric, Syracuse N.Y. $5,217,-000. Anti-jam improvement kits for the Hercules weapons system. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0287.

—Techfab Div. of ALSCO, Inc., St. Louis Mo. $1,510,687. XM–159C airborne rocket launchers. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0729.

—Raytheon Co., Andover, Mass. $1,123,429. Product assurance and engineering services for the self-propelled Hawk missile system. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0657.

—Minnesota Mining and Mfg. Co., Camarillo, Calif. $1,000,000. Classified electronic equipment. Electonics Command, Fort Monmouth, N.J.

—General Electric, Burlington, Vt. $10,773,-720. 20mm air defense artillery guns. Army Procurement Agency, New York, N.Y. DA AG25–69–C–0403.

—Chamberlain Mfg. Corp., Elmhurst, Ill. $13,443,600. Metal parts for 175mm projectiles. Scranton, Pa. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0225.

—U.S. Steel, Pittsburgh, Pa. $11,875,000. Metal parts for eight-inch projectiles. Berwick, Pa. Ammunition Procurement & Supply Agency, Joliet, Ill DA AA09–69–C–0226.

—L, E. Mason Co., Hyde Park, Mass. $1,-579,368. Metal parts for M126 nose body assemblies for M36 bomb clusters. Edgewood Arsenal, Md. DA AA15–69–C–0169.

—Amron Corp., Waukesha, Wis. $2,030,980. Brass cartridge cases for 20mm ammunition. Frankford Arsenal, Philadelphia, Pa. DA AA25–69–C–0202.

—Bell Helicopter Co., Fort Worth, Tex. $7,161,671. UH–1H helicopters. Aviation Materiel Command, St. Louis, Mo. DA AJ01–68–C–0566.

—Hughes Aircraft, Culver City, Calif. $1,719,262 (contract modification). Missile guidance sets for TOW weapons system. El Segundo, Calif. Army Missile Command, Huntsville, Ala. DA AH01–69–A–0002.

—J. R. Hollingsworth Co., Phoenixville, Pa. $4,513,988. $3,606,173. Generator sets. Mobility Equipment Command, Warren,

Mich. DA AK01-68-C-1573. DA AK01-68-C-1572.

—**General Motors,** Ypsilanti, Mich. $18,720,-000. M16A1 rifles. Army Weapons Command, Rock Island, Ill. DA AF03-68-C-0048.

—**Harrington & Richardson, Inc.,** Worcester, Mass. $13,254,300. M16A1 rifles. Army Weapons Command, Rock Island, Ill. DA AF03-68-C-0045.

DEPARTMENT OF THE NAVY

1—**Stanwick Corp.,** Washington, D.C. $1,912,-465. Development and analysis of management information products for various naval commands. Arlington, Va. Naval Ship Systems Command. N00024-69-C-5024.

—**Horne Bros., Inc.,** Newport News, Va. $1,095,095. Regular overhaul of the landing ship tank USS Suffolk County (LST-1173). Supervisor of Shipbuilding, Construction and Repair, Fifth Naval Dist., Newport News, Va. N62678-67-C-0013.

2—**Grumman Aircraft Engineering Corp.,** Bethpage, N.Y. $5,755,000 (contract modification). Incremental funding for E-2C aircraft. Naval Air Systems Command. N00019-68-C-0542.

—**Raytheon Co.,** Lowell, Mass. $3,703,788. Guidance and control groups for Sidewinder 1C missiles. Naval Air Systems Command. N00019-69-C-0056.

—**Pyrotector, Inc.,** Hingham, Mass. $1,357,-167. Fire suppression equipment and spare parts. Naval Ship Systems Command. N00024-69-C-5138.

3—**North American Rockwell Corp.,** Columbus, Ohio. $71,757,000 (contract modification). FY 1969 procurement of RA-5C aircraft. Naval Air Systems Command. N00019-68-C-0190.

—**American Mfg. Co.,** Fort Worth, Tex. $13,086,920. MK 52, MOD O, five-inch 38-cal. projectiles. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0096.

—**FMC Corp.,** San Jose, Calif. $2,000,000. Design, development and construction of two assault amphibious vehicles. Naval Ship Systems Command. N00024-69-C-0227.

—**United Aircraft,** Windsor Locks, Conn. $2,173,830 (contract modification). Propeller systems for P-3C aircraft. Naval Air Systems Command. N00019-68-C-0543.

—**Lansdowne Steel & Iron Co.,** Morton, Pa. $1,926,000. MK 52, MOD 0, five-inch, 38-cal. projectiles. Navy Ships Parts Control Center, Mechanicsburg, Pa. N000104-69-C-0095.

—**Johns Hopkins University Applied Physics Laboratory,** Silver Spring, Md. $1,877,772. Work on the Bumblebee project. Naval Ordnance Systems Command. NOw-62-0604C.

—**TYCO Labs, Inc.,** Fairfield, N.J. $1,852,-200. MK 29, MOD 3, fuzes. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0076.

—**RCA,** Moorestown, N.J. $1,325,841. An instrumentation radar system. Navy Purchasing Office, Los Angeles, Calif. N00123-69-C-0493.

—**Futuronics Corp.,** Port Washington, N.Y. $2,388,000. Electronic shops for the Fleet Marine Forces. Headquarters, Marine Corps. M00027-69-C-0045.

4—**Beech Aircraft,** Wichita, Kan. $4,298,999. AQM-37A targets. Naval Air Systems Command. N00019-69-C-0174.

—**M-R-S Mfg. Co.,** Flora, Miss. $1,253,830. Tractors. Headquarters, Marine Corp. M00027-69-C-0049.

7—**Texas Instruments,** Dallas, Tex. $9,576,-763. Shrike missile guidance and control sections. Naval Air Systems Command. N00019-69-C-0116.

—**Lasko Metal Products,** Westchester, Pa. $4,777,170. LAV-10A rocket launchers. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0102.

8—**Little, Inc.,** Cambridge, Mass. $1,200,338. Research and development study of testing and implementation of computer aided ship cutting machinery. Naval Ship Systems Command. N00024-69-C-0233.

9—**North American Rockwell Corp.,** Anaheim, Calif. $8,825,000 (contract modification). Bomb navigational systems components for use on various aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-67-Z-5502-0279 MOD-AB.

—**Westinghouse Electric,** Baltimore, Md. $2,050,000. Production of torpedo targets for use in evaluating the MK 48 torpedo weapons system. Naval Ordnance Systems Command. N00017-68-C-1222.

—**Cosmodyne Mfg. Co.,** Louisville, Ky. $1,-663,200. Missile cradles used for storing, shipping and transferring Rockeye II cluster bombs from tidewater depots to combat ships and/or ammunition ships for service. Navy Purchasing Office, Los Angeles, Calif. N00123-69-C-0600.

—**McDonnell-Douglas Corp.,** Long Beach, Calif. $1,434,300. Cap assembly breeches for various aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-68-A-3200-0338.

10—**United Aircraft,** Stratford, Conn. $7,900,-000 (contract modification). Long lead time effort and materials for CH-53C helicopters. Naval Air Systems Command N00019-67-C-0401.

—**Raytheon Co.,** Sudbury, Mass. $5,273,218. Poseidon guidance system design effort. Strategic Systems Project Office. N00030-66-C-0159.

—**McDonnell Douglas Corp.,** St Louis, Mo. $2,400,000 (contract modification). Long lead time effort and materials to support FY 1969 procurement of F-4E aircraft. Naval Air Systems Command. N00019-68-C-0495.

—**Industrial Contractors,** Idaho Falls, Idaho. $1,487,000. Construction of a power plant at the Satellite Test Annex, Sunnyvale, Calif. Western Div., Naval Facilities Engineering Command, San Bruno, Calif. N62474-68-B-0250.

—**Boeing Co.,** Seattle, Wash. $6,000,000. Contract definition phase of the Advanced Surface Missile System program. Naval Ordnance Systems Command. N00017-69-C-2401.

—**General Dynamics,** Pomona, Calif. $6,000,-000. Contract definition phase of the Advanced Surface Missile System program. Naval Ordnance Systems Command. N00017-69-C-2402.

—**RCA,** Moorestown, N.J. $6,000,000. Contract definition phase of the Advanced Surface Missile System program. Naval Ordnance Systems Command. N00017-69-C-2403.

11—**General Electric,** Schenectady, N.Y. $17,-000,000. Nuclear reactor components. Naval Ship Systems Command. N00024-67-C-5056.

—**Western Electric,** New York. N.Y. $11,-873,316. Oceanographic research. Whippany, N.J.; $1,180,500. Specialized test equipment. Winson-Salem and Burlington, N.C. Naval Electronic Systems Command. N00039-C-3508. N00039-69-C-3514.

—**Waltham Precision Instrument, Inc.,** Waltham, Mass. $1,040,011. Demolition firing devices. Naval Ammunition Depot, Crane, Ind. N00164-69-C-0195.

15—**General Electric,** Schenectady, N.Y. $15,-960,000. Nuclear reactor compartment components. Naval Ship Systems Command. N00024-69-C-5154.

—**General Electric,** Washington, D.C. $4,-793,000. Operation support services for Polaris fire control systems and related support equipment. Pittsfield, Mass.; $15,-000,000. Poseidon fire control and support equipment (phase IIIB). Pittsfield, Mass. Strategic Systems Project Office. N00030-69-C-0074. N00030-69-C-0125.

—**Westinghouse Electric,** Washington, D.C. $13,035,000. Poseidon launcher systems. Sunnyvale, Calif. Strategic Systems Project Office. N00030-69-C-0138.

—**Gould National Batteries,** St. Paul, Minn. $3,728,692. Submarine batteries. Kankakee, Ill. and Trenton, N.J. Naval Ship Systems Command. N00024-69-C-5187.

—**Philco-Ford Corp.,** Fort Washington, Pa. $1,278,351. Engineering services involving installation, testing, checkout, adjustment and on-the-job maintenance training for various electronic equipment. Naval Ship Systems Command. N00024-69-C-1015.

—**General Dynamics,** Groton, Conn. $1,000,-000. Engineering and planning shipyard services to support alteration, maintenance and repair of operational submarines. Naval Ship Systems Command. N00024-69-C-0239.

16—**Columbia University,** New York, N.Y. $2,000,000. Research in underwater sound and related subjects. Office of Naval Research.

—**General Atronics Corp.,** Philadelphia, Pa. $1,515,399. Manufacture of oscilloscopes and accessories. Naval Electronic Systems Command. N00039-69-C-2507.

—**M.I.T.,** Cambridge, Mass. $1,500,000. Design and development of an advance guidance system for Poseidon. Strategic Systems Project Office. N00030-69-C-0089.

17—**American Machine & Foundry Co.,** York, Pa. $41,959,484. MK 82, MOD 1, 500-lb. bomb bodies. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0117.

—**Maxson Electronics Corp.,** Macon, Ga. $4,224,000. MK 31, MOD 2, base detonating fuzes. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0079.

—**Western Molded Fibre Products,** Gardena, Calif. $1,305,000. Rocket launcher fairings for Zuni rockets. Navy Ships Parts Control Center, Mechanicsburg, Pa. N-00104-69-C-0089.

—**United Aircraft,** Hartford, Conn. $1,780,-628. Spare parts for J52 and TF-30 aircraft engines. Aviation Supply Office, Philadelphia, Pa. N00383-9-69-000A-AF818.

—**General Dynamics,** Groton, Conn. $1,000,-000. Engineering and planning shipyards services to conduct hull planning yard fuctions and related work. Naval Ship Systems Command. N00024-69-C-0240.

18—**North American Rockwell Corp.,** Anaheim, Calif. $6,147,146. Modification of Government-furnished ships inertial navigation systems equipment. Naval Ship Systems Command. N00024-69-C-5067.

—**General Electric,** Schenectady, N.Y. $1,-683,000. Design and furnish nuclear propulsion components. Navy Ships Systems Command. N00024-67-C-5014.

21—**Honeywell, Inc.,** Minneapolis, Minn. $15,-473,235. Rockeye II components. Naval Air Systems Command. N00019-69-C-0163.

22—**American Cement Corp.,** Los Angeles, Calif. $2,025,324. Cement. Oro Grande, Calif. Navy Purchasing Office, Los Angeles, Calif. N00123-69-D-0432.

—**United Aircraft,** East Hartford, Conn. $1,746,268. TF30 engine spare parts for A7A and A7B aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-69-C-000A AF835.

—**Simplex Wire & Cable Co.,** Newington, N.H. $1,500,000. Manufacture of oceanographic equipment. Naval Electronic Systems Command. N00039-69-C-3513.

—**Willamette Iron & Steel Co.,** Portland, Ore. $1,385,500. Regular overhaul of the landing ship dock USS Comstock (LSD-19). Supervisor of Shipbuilding, Conversion and Repair 13th Naval Dist., Seattle, Wash. N62799-69-B-0003.

—**Honeywell, Inc.,** Minneapolis, Minn. $3,-392,850. Rockeye II components. Hopkins, Minn. Naval Air Systems Command. N00019-68-C-0315.

—**North American Rockwell Corp.,** Columbus, Ohio. $2,520,000. Design, development, fabrication and testing of a naval intelligence processing system. Naval Air Systems Command. N00019-68-C-0525.

—**Bunker-Ramo Corp.,** Silver Spring, Md. $1,104,000. Work on ECM equipment. Naval Air Systems Command. N00019-68-C-0210.

—**United Steel Corp.,** Pittsburgh, Pa. $25,-619,166. 500-lb. bomb bodies. McKeesport, Pa. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68-C-3599 MOD PO11.

—**Conco, Inc.,** Mendota, Ill. $1,768,068. MK 77, MOD 2, bombs. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0127.

—**Intercontinental Mfg. Co.,** Garland, Tex. $13,383,668. 500-lb bomb bodies; $6,226,-155. 2000-lb. bomb bodies. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0129. N00104-69-C-0119.

23—**George G. Sharp, Inc.,** New York, N.Y. $1,117,774. Preparation of the basic ship systems design for a nuclear guided missile frigate. Naval Ship Systems Command. N00024-69-C-5203.

24—**Hazeltine Corp.,** Little Neck, N.Y. $1,994,-004. Sonar transducers for naval ships. Braintree, Mass. Naval Ship Systems Command. N00024-69-C-1084.

—**General Time Corp.**, Skokie, Ill. $1,514,-621. Mechanical time fuzes, plus shipping and storage containers. Naval Air Systems Command. N00019-69-C-0154.

—**Western Molded Fiber Products**, Gardena, Calif. $1,544,629. Cork plugs. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0091.

—**Whittaker Corp.**, Saugus, Calif. $2,721,-400. Electric primers for 5-inch, 54-cal. projectiles. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0124.

—**Maxon Electronics Corp.**, Macon, Ga. $1,799,600. $1,745,280. Electric primers for 5-inch, 54-cal. projectiles. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0115. N00104-69-C-0123.

25—**General Electric**, Pittsfield, Mass. $2,716,-349. Production of gun and guided missile directors for the Tartar weapon system and for related equipment for the navies of certain member nations of NATO. Naval Ordnance Systems Command. N00017-69-C-2302.

—**General Precision Systems**, Glendale, Calif. $2,382,607. Production of fire control system MK 113, MOD 9. Naval Ordnance Systems Command. N00017-69-C-1410.

—**General Instrument Corp.**, Hicksville, N.Y. $1,990,994. Portable radar units. Naval Electronic Systems Command. N00039-68-C-0549.

—**E.E. Black, Ltd.** Honolulu, Hawaii. $1,-353,400. Construction of barracks at Camp Smith, Oahu, Hawaii. Pacific Div., Naval Facilities Engineering Command. Pearl Harbor, Hawaii. N62471-69-B-0293.

—**Fairchild Camera & Instrument Corp.**, Syosset, N.Y. $1,041,000 (contract modification). Fuzes for 5-inch, 38-cal. ammunition. Copiague, N.Y. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68-C-0702.

—**General Electric**, Schenectady, N.Y. $1,-000,000. Nuclear propulsion research and development. Naval Ship Systems Command. N00024-67-C-5016.

28—**LTV Aerospace Corp.**, Dallas, Tex. $31,-000,000 (contract modification). Long lead time effort for FY 1969 procurement of A-7E aircraft. Naval Air Systems Command. N00019-68-C-0075.

—**General Electric**, Washington, D.C. $24,-036,424. Poseidon fire control and support equipment. Pittsfield, Mass. Strategic Systems Project Office. N00030-68-C-0161.

—**General Electric**, Cincinnati, Ohio. $4,842,-409. $1,801,938. Spare engine parts for RA-5C, F-4B and F-4J aircraft. Aviation Supply Office, Philadelphia. Pa. F34601-68-D-2525-GB34 and F34601-68-D-2526-GB35.

—**Gibbs Mfg. & Research Corp.**, Janesville, Wis. $3,338,808. MK 346, MOD 0, bomb fuzes for MK 80 series bombs. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0111.

—**Tasker Industries**, Van Nuys, Calif. $1,-160,816. Design, development and fabrication of radar systems and associated radar control equipment. Naval Air Systems Command. N00019-69-C-0183.

—**Honeywell, Inc.**, St. Petersburg, Fla. $1,-084,600. Repair of Polar's pendulated integrated gyro assemblies for FY 1969. Strategic Systems Project Office. N00030-69-C-0076.

—**Columbia University**, New York, N.Y. $1,200.000. Research in undersea acoustics. Office of Naval Research.

29—**Firestone Tire & Rubber Co.**, Akron, Ohio. $1,035,000. Inflatable life boats. Magnolia, Ark. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-D-0169.

30—**James A. Mann. Inc.**, Philadelphia, Pa. $1,454,000. Construction work in two buildings at the Defense Personnel Support Center, Philadelphia, Pa. Naval Facilities Engineering Command. N62472-67-C-0301.

—**James E. Cox Construction, Inc.**, Charlotte, N.C. $1,729,883. Construction of an explosive engineering development facility at the Naval Weapons Station, Yorktown, Va. Naval Facilities Engineering Command. N62470-68-C-0534.

—**Norge Associates, Inc.**, Sea Cliff, N.J. $1,489,180. Construction of a Detection, Intercept—Passive Submarine (DIPS) training building at the Naval Submarine School, New London, Conn. Naval Facilities Engineering Command. N62319-68-C-0044.

—**Treadwell Corp.**, New York, N.Y. $1,944,-000. Overhaul and repair of submarine oxygen generators. Naval Ship Systems Command. N00024-69-C-5189.

31—**Westinghouse Electric**, Baltimore, Md. $3,590,888. Spare parts in support of AN/APG59 radar sets for F-4J aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-69-A-4900-0020.

—**Curtiss Wright Corp.**, Wood-Ridge, N.J. $2,753,145. Spare parts to support J65 engines for A-4 aircraft. Aviation Supply Office, Philadelphia, Pa. F41608-67-A-5900.

—**Sperry Rand Corp.**, Syosset, N.Y. $1,767,-249. Technical planning assistance in the inertial navigation sub-systems of the Poseidon missile conversion program. Naval Ship Systems Command. N00024-69-C-5191.

—**Standard Products Co.**, Cleveland, Ohio. $1,098,900. 2,220 track section repair kits. Port Clinton, Ohio. Headquarters, Marine Corps. M00150-69-C-0109.

DEPARTMENT OF THE AIR FORCE

1—**ITT Corp.**, Nutley, N.J. $1,963,000. Production of telephone communications equipment. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F34-601-69-C-0248.

2—**General Electric**, West Lynn, Mass. $3,-800,000 (contract modification). Engineering-development work on the T-58 aircraft engine. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0730 P001.

3—**Hughes Aircraft**, Culver City. Calif. $3,250,000. Production of modification kits for Falcon missiles. Tucson, Ariz. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-69-C-0941.

—**LTV Electrosystems, Inc.**, Greenville, Tex. $1,526,216. $5,816,914. Maintenance, repair and modification of C-130 and C-133 aircraft. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-69-C-0660. F09603-69-C-0137.

—**Fairchild Hiller Corp.**, St. Augustine, Fla. $3,503,880. Maintenance, repair and modification of C-130 aircraft. St. Petersburg, Fla. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-69-C-0873.

—**American Airmotive Corp.**, Miami, Fla. $1,328,588. Maintenance, repair and modification of B-57 aircraft. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-69-C-0978.

—**Electronic Communications, Inc.**, St. Petersburg, Fla. $1,827,574. Production of components for AN/ARC-89 (V) communications systems Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-69-C-0814.

—**General Electric**, Ontario, Calif. $3,107,-310. Overhaul of hydraulic components for B-52 aircraft. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. AF 34(601)-69-D-0352.

4—**Hallicrafters Co.**, Rolling Meadows, Ill. $1,127,165 (increment to an existing contract). Production of electronic tubes. Chicago, Ill. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-68-C-0328.

—**Hallicrafters Co.**, Rolling Meadows, Ill. $1,112,600 (increment to an existing contract). Modification of airborne countermeasure equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0582.

—**Curtiss-Wright Corp.**, Wood-Ridge, N.J. $3,640,672. Overhaul of J-57 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. F41608-69-D-0290.

—**Bendix Corp.**, Teterboro, N.J. $1,100,000. Airborne navigational computer systems. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-69-C-0319

—**Texas Instruments**, Dallas, Tex. $1,000,-000. Production of airborne radar for RF-4 aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-69-C-0251.

—**General Electric**, Cincinnati, Ohio. $1,000,-000. Development of an advanced turbine-engine gas generator. Evendale, Ohio. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF3/657/16495.

—**Thiokol Chemical Corp.**, Bristol, Pa. $5,-117,615. Preproduction qualification of Stage III Minuteman motors. Brigham City, Utah. Space & Missile Systems Organization, (AFLC), Los Angeles, Calif. FO4701-68-C-0175.

7—**System Development Corp.**, Santa Monica, Calif. $1,000,000. Computer program integration. Air Force Satellite Control Facility, Los Angeles, Calif. F04701-69-C-0011.

8—**General Electric**, West Lynn, Mass. $4,-730,000. Production of engines for T-2C aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-69-C-0005.

—**Hayes International Corp.**, Dothan, Ala. $2,807,196. Inspection, repair and maintenance of C-118 aircraft. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-69-C-0758.

—**Curtiss Wright Corp.**, Caldwell, N.J. $1,400,438. Overhaul of propeller assemblies applicable to C-124 and C-133 aircraft. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-69-D-0090.

—**Aero Corp.**, Lake City, Fla. $1,262,100. Inspection, repair and maintenance of C-121 aircraft. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. F04606-69-C-0060.

9—**Fairchild Hiller Corp.**, Farmingdale, N.Y. $2,900,000. Modification of F-105 flight control and navigation systems; $2,100,-000. Modification and flight testing of the F-105 weapons delivery system. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. F04606-68-C-1056. F04606-68-C-1055.

10—**United Aircraft**, East Hartford, Conn. $1,662,060. Production of spare parts for J57 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. N383-69-000A.

11—**Dynamics Corp. of America**, Bridgeport, Conn. $1,624,952. $4,360,724. Production of generator sets. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. F04606-68-D-0575-0006. F04606-67-D-70321-0003.

—**General Motors**, Indianapolis, Ind. $7,661,-206. Production of modification kits for T-56 jet engines. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F34601-68-A-0532-0128.

—**United Aircraft**, Stratford, Conn. $3,518,-572. Production of components for HH-53 helicopters. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-69-A-0029-0046.

14—**General Electric**, Utica, N.Y. $1,351,000. Spare parts and components for airborne electronics equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-69-C-0367.

—**AVCO Corp.**, Stratford, Conn. $8,178,190. Work on the MK 11-A reentry vehicle. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. AF 04-694-971.

15—**General Motors**, Indianapolis, Ind. $1,416,-270. Production of compressor blades applicable to T56 aircraft engines. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F4601-68-D-0522-0007.

—**Hughes Aircraft**, Culver City, Calif. $3,030,500. Production of components and spare parts for airborne electronic systems. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F04606-68-A-0225.

—**ITT Research Institute**, Chicago, Ill. $4,-500,000. Operation of an electromagnetic compatibility analysis center. Annapolis, Md. Electronics Systems Div., (AFSC), L. G. Hanscom Field, Mass. F19628-69-C-0073.

—**Whittaker Corp.**, Columbus, Ohio $19,089,-911. Production of bomb components. Armament Development Test Center, Eglin AFB, Fla. F08635-69-C-0016.

—**Mc Donnell Douglas Corp.**, Santa Monica, Calif. $4,621,460. Launch support services at Vandenberg AFB, Calif., from Oct. 1, 1968, to March 31, 1970, for various space programs. Space & Missle Systems Or-

ganization, (AFSC), Los Angeles, Calif. F04701-68-C-0249.

16—**Mitre Corp.**, Bedford, Mass. $9,639,750. Research and development for system design, system engineering, intersystem integration, and research and experimentation to achieve continuing advances in the field of information and communication systems. Electronic Systems Div., (AFSC), L. G. Hanscom Field, Mass. F19628-68-C-0365.

—**Aerodex Inc.**, Miami, Fla. $4,071,744. Overhaul and modification of T-56 aircraft engines. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F34601-69-0098.

—**Technicolor, Inc.**, Hollywood, Calif. $2,923,873. Photo optical instrumentation and related support services. Patrick AFB, Fla. Procurement Div., Patrick AFB, Fla.

17—**Ryan Aeronautical Co.**, San Diego, Calif. $5,830,240. Aerial target drones. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**Sperry Rand Corp.**, Salt Lake City, Utah. $3,073,875. Development and fabrication of a data relay system. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0910-P007.

18—**General Electric**, Cincinnati, Ohio. $11,710,200. Production of J79 turbojet engines in support of the F-4E aircraft. Evendale, Ohio. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F03657-68-C-1232.

—**Boeing Co.**, Wichita, Kan. $3,600,000. Engineering services for the FY 1969 B-52 fleet support program. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F34601-68-C-4560.

—**Cutler-Hammer, Inc.**, Deer Park, N.Y. $2,657,228. Production of airborne radio equipment. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F34601-68-A-3106.

21—**American Electric, Inc.**, La Mirada, Calif. $25,854,760. Production of 750-lb. bombs. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. F42600-69-C-2205.

—**Northrop Corp.**, Hawthorne, Calif. $3,700,000. T-38 aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-69-C-0150.

—**M.I.T.**, Cambridge, Mass $2,006,000. Advanced development of a re-entry guidance system. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. F04701-69-C-0123.

22—**General Electric**, Cincinnati, Ohio $41,847,757 (final increment to a previously awarded contract). Production of J79 engines in support of the F-4J aircraft program. Evendale, Ohio. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0632.

—**Hughes Aircraft**, Culver City, Calif. $1,200,000. Development of advanced fire control/missile technolgy. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33615-69-C-1108.

—**United Aircraft of Canada, Ltd.**, Longueuil, Quebec, Canada. $1,398,831. Spare parts applicable to R-4360 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex.

23—**American Electric**, La Mirada, Calif. $4,385,047. Production of aircraft ordnance. Ogden Air Materiel Area, (AFLC). Hill AFB, Utah. F42600-69-C-2216.

—**United Aircraft**, East Hartford, Conn. $1,459,656. Production of spare parts for TF33 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. N383-69-C-000A SA-69-459.

—**United Aircraft**, East Hartford, Conn. $1,412,736. Production of spare parts for J57 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. N383-69-C-000A SA-69-422.

—**United Aircraft**, East Hartford, Conn. $1,000,000. Development work on an advanced turbine engine gas generator. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0362.

25—**McDonnell Douglas Corp.**, St. Louis, Mo. $5,000,000. Re-entry vehicle developmental flight tests. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. F04701-68-C-0034.

—**Boeing Co.**, Seattle, Wash. $1,447,964. Production of Minuteman missiles and related equipment. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. AF04 (694)-896.

28—**Fairchild Camera & Instrument Corp.**, Syosset, N.Y. $1,825,005 (contract modification). Production of aircraft cameras. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0896-P002.

29—**Bendix Corp.**, Teterboro, N.Y. $1,613,110 (contract modification). Production of aircraft instruments. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-67-C-0844-P003.

—**Texas Instruments, Inc.**, Dallas, Tex. $1,517,027 (contract modification). Manufacture of components of electronic equipment for F-4C aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0379-P005.

30—**Lockheed Aircraft**, Marietta, Ga. $16,019,682. C-130H aircraft, data, spare parts, aerospace ground equipment, and spare parts for aerospace ground equipment for MAP. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-69-C-0242.

31—**Philco Ford Corp.**, Philadelphia, Pa. $1,608,889. Production of communications modification kits. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F34601-68-A-2705.

ARISTOTLE Symposium Proceedings Published

The National Security Industrial Association (NSIA) has published a 642-page illustrated manual which describes the results of the first ARISTOTLE Symposium, held Dec. 6–7, 1967, in Washington, D.C.

Project ARISTOTLE (acronym for Annual Review and Information Symposium on the Technology of Training, Learning and Education) was established to provide a structure to encourage continuing communication and exchange of accomplishments within the government/industry/education communities.

Topics covered in the manual include:

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Copies of "Proceedings of Project ARISTOTLE Symposium" can be ordered, at a cost of $11 per copy, from the following address:

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Gravity Measurement Accuracy Improved by New Instrument

A new gravity measuring apparatus—the most precise instrument of its type ever developed—has been installed at the Air Force Cambridge Research Laboratories (AFCRL), Bedford, Mass.

Based on the principle of clocking the rate of speed of a falling object, the new instrument was developed for AFCRL and the National Bureau of Standards by James E. Faller of Wesleyan University.

The apparatus, which has a vertical length of 10 feet, is essentially a Michelson-type interferometer with a helium-neon light source. The heart of the system is an evacuated four-foot drop chamber. Associated with the apparatus is an array of electronic timing gear.

At AFCRL, the apparatus will be placed on a concrete seismic pier built on bedrock. Part of the apparatus itself is a seisomometer for sensing and correcting vibrations.

Initial measurements with the instrument suggest that it is capable of precisions approaching one part in a hundred million. With this degree of accuracy, the new laser-interferometer apparatus will be able to measure the minute (several parts in 10 million) tidal variations caused by the attraction of the sun and the moon with greater precision than any previous absolute gravity instrument.

After the gravity values for the Cambridge site have been measured and averaged, the AFCRL installation will serve as a standard to which other gravity instruments can be brought for calibration.

The laser-interferometer apparatus will remain in place at AFCRL only until the gravity value at the site has been established. It will then be transported to other locations by AFCRL for similar measurements.

The AFCRL gravity measuring program, which includes both the development of new gravity instruments and the use of the instruments to measure gravity values at various locations, is under the direction of Bela Szabo.

Bulletin Conducts Annual Readership Survey

Each year the Joint Congressional Committee on Printing requires the *Defense Industry Bulletin* to verify its subscriber list. A survey card has been mailed to each addressee. Every reader who wishes to receive the *Bulletin* for another year must return the survey card appropriately marked by January 1, 1969. New subscribers, whose issues began with the November *Bulletin,* will continue to receive the magazine throughout 1969, and will not receive a survey card.

An old subscriber who has not received his survey card already may use the top of this page to renew his subscription. Fill in the appropriate spaces to the right, cut off the top portion of this page, and send it to the Editor, Defense Industry Bulletin, OASD(PA), Pentagon, Washington, D.C. 20301. **Be sure to clip the entire top portion of this page so that your mailing label appears on the reverse side of this form.**

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Chemical Field Alarm System Nears Completion

The Army has achieved a breakthrough in chemical warfare defense with a new chemical field alarm system nearing completion of development by scientists and engineers at Edgewood Arsenal, Md.

The new portable chemical agent alarm (XM8) will provide U.S. field forces, for the first time, with automatic means of detection and warning of the presence of nerve agents.

Effective detection devices have been available previously but lacked automatic alarm capabilities suitable for use by field troops.

Need for an adequate detection and alarm system is essential because the various nerve agents are odorless and colorless, and very small doses are lethal.

The heart of the XM8 is an electrochemical cell which samples air continuously. The presence of nerve agents causes the cell to produce electric energy which triggers the alarm.

The complete system consists of six components—a detector unit, a remote alarm, a power source, detector refill kit, field test kit and vehicle mounting kit.

Special consideration was given to the design of the alarm system to make it as rugged, compact and lightweight as possible. The end product measures about 26 inches high, 12 inches wide and 8 inches deep. Complete with its battery power-pack which can operate the detector and alarm for a minimum of 12 hours, it weighs less than 18 pounds.

Light enough to be carried by an individual soldier, the alarm can also be vehicle mounted or used in fixed emplacements.

Designed for use in a wide variety of tactical and environmental situations, the alarm has successfully been tested at temperatures ranging from −40 degrees to +120 degrees Fahrenheit.

The new alarm is extremely sensitive and will detect minute amounts of nerve agent vapor in below-lethal concentrations.

The research and development team at Edgewood Arsenal was headed by John C. Young, a supervisory chemist, who heads the Alarms Branch in the arsenal's Warning and Detection Laboratory.

The Bendix Corp., Towson, Md., was the principal contractor, with major contributions being made by the Southern Research Institute of Birmingham, Ala.

Navy Expands SEALAB Aquanaut Teams

The U.S. Navy has increased the size of its SEALAB III capsule crews to include four more aquanauts.

Addition of the four divers, three Navymen and one civilian, brings the total number of aquanauts who will occupy the undersea research capsule to 44.

Four of the five aquanaut teams, which will spend 12-day periods working in the underwater habitat located off the coast of Southern California at a depth of 600 feet, will be increased from eight to nine members.

Size of the habitat teams was increased to expedite completion of the ambitious SEALAB III scientific program by improving the work and rest schedules.

The four additional occupants of the capsule were drawn from the existing group of qualified aquanauts. Other qualified divers will serve as surface support members of the experiment and will be on call if replacements are needed.

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DOD Supports Space Missions

Project Apollo, of the National Aeronautics and Space Administration (NASA), will culminate in a manned lunar landing. Since the first U.S. manned venture, Project Mercury, the Defense Department has provided massive support to the space program.

When John Glenn made three orbits of the earth, DOD had 20,000 persons, 126 aircraft and 24 ships deployed around the world to support the mission. By the time of the two-man Gemini project, increased accuracy and efficiency of support permitted a reduction of DOD forces. During Gemini 8, when astronauts Neil Armstrong and David Scott were forced to make an unplanned landing in the Pacific, DOD support had been reduced to 9,665 persons, 96 aircraft and 18 ships. Despite reduced support, an Aerospace Rescue and Recovery Service aircraft was able to reach its new recovery station in time to sight the spacecraft while it was still decending by parachute.

Apollo missions bring new challenges to DOD support personnel. The spacecraft is 6,000 pounds heavier, and there are three astronauts to recover. Efficiency of space flight support has increased with new specifically designed equipment, such as Apollo Range Instrumentation Aircraft and Apollo Instrumentation Ships.

For Apollo 7 mission DOD furnished about 7,200 persons, 49 aircraft and 14 ships from Air Force, Navy and Marine units.

During an Apollo mission, DOD land tracking stations, ships and aircraft join the NASA Manned Space Flight Network to form a global tracking and instrumentation system. These stations provide C-band and unified S-band radar tracking, telemetry, and command communications links to the spacecraft. During liftoff, a new Airborne Lightweight Optical Tracking System provides 70mm high-resolution motion picture coverage from a C-135 aircraft flying at 40,000 feet.

The North American Air Defense Command participates by furnishing NASA headquarters with tracking and impact prediction for all residuals left in orbit, flight plan updates, significant events and positions, and velocity vectors.

Eight EC–135N Apollo range instrumentation aircraft are assigned to the Air Force Eastern Test Range to support space flights. The four-engine jets carry 10-foot diameter "droop-snoots" which house seven-foot diameter antennas, the largest steerable antennas ever flown. The planes are packed with the latest electronic instrumentation—equipment specially designed for Apollo missions. Two of these aircraft, working as a pair, can provide 5,000 miles of continuous coverage.

Five Apollo instrumentation ships support space flight. In addition to providing electronic support, the ships can act as standby recovery vessels or standby mission control centers. Converted World War II "Liberty" tankers and transports, the ships have been extensively modified with inertial navigation equipment and other positioning systems. Three of the ships have satellite communications terminals, permitting instant communication with Mission Control Center-Houston. The Military Sea Transport Service sails the ships for the Air Force Western Test Range.

Emergency recovery in the Launch Site Recovery area would be provided by Air Force helicopters, Marine Corps tracked recovery landing vehicles for operations in the surf, and Navy landing craft for deeper water recovery. Launch Abort Recovery, covering the time after the escape tower is jettisoned until orbit is attained, would be performed by ships and aircraft stationed in a 100-nautical-mile corridor centered on the normal ground track of the Apollo capsule.

In the Primary Landing Area, where the planned end of mission occurred, the USS Essex was the primary recovery ship for Apollo 7. Four other secondary landing areas have been designated for Apollo missions, in the East and West Atlantic and in the West and Mid-Pacific. Ships and aircraft cover all the recovery areas.

DOD Manager for Manned Space Flight Support Operations is Major General Vincent G. Huston, USAF.

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